

# 1

## Developments in the Business Environment

### Basic Concepts

<b>A Bottleneck</b>	A Bottleneck is an activity within the organisation where the demand for that resource is more than its capacity to supply.
<b>A Constraint</b>	A Constraint is a situational factor which makes the achievement of objectives / throughput more difficult than it would otherwise be. Constraints may take several forms such as lack of skilled employees, lack of customer orders or the need to achieve a high level of quality product output.
<b>Activity Based Budgeting</b>	<p>Activity Based Budgeting (ABB) is a process of planning and controlling the expected activities for the organisation to derive a cost-effective budget that meets forecasted workload and agreed strategic goals.</p> <p>An activity-based budget is a quantitative expression of the expected activities of the firm, reflecting management's forecast of workload and financial and non-financial requirements to meet agreed strategic goals and planned changes to improve performance. Thus, the key elements of ABB are:</p> <ul style="list-style-type: none"><li>- Type of work / activity to be performed;</li><li>- Quantity of work / activity to be performed; and</li><li>- Cost of work / activity to be performed.</li></ul>
<b>Activity Based Costing</b>	<p>Activity Based Costing is an accounting methodology that assigns costs to activities rather than products or services. This enables resources &amp; overhead costs to be more accurately assigned to products &amp; services that consume them.</p> <p>CIMA defines 'Activity Based Costing' as an approach to the costing and monitoring of activities which involves tracing resource consumption and costing final outputs. Resources are assigned to activities, and activities to cost objects based</p>

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	on consumption estimates. The latter utilise cost drivers to attach activity costs to outputs.
<b>Activity Based Cost Management</b>	<p>The term Activity Based Management (ABM) is used to describe the cost management application of Activity Based Costing (ABC).</p> <p>CAM-1 defines ABM as ‘A discipline that focuses on the management of activities as the route to improving the value received by the customer and the profit achieved by providing this value. This discipline includes cost driver analysis, activity analysis, and performance measurement. Activity-Based Management draws on Activity-Based Costing as its major source of information’.</p>
<b>Activity Cost Pool*</b>	Aggregation of all costs related to a specific activity.
<b>Activity Driver*</b>	Transaction that causes an activity.
<b>Activity Driver Analysis*</b>	Identification and evaluation of the activity drivers used to trace the cost of activities to cost objects.
<b>Activities, Hierarchy*</b>	Classification of activities by level of organisation, for example unit, batch, product sustaining and facility sustaining.
<b>Benchmarking</b>	Benchmarking is the process of identifying and learning from the best practices anywhere in the world. It is a powerful tool for continuous improvement.
<b>Back-flushing</b>	Back-flushing requires no data entry of any kind until a finished product is completed. At that time the total amount finished is entered into the computer system, which multiplies it by all the components listed in the bill of materials for each item produced. This yields a lengthy list of components that should have been used in the production process and which are subtracted from the beginning inventory balance to arrive at the amount of inventory that should now be left on hand. Given the large transaction volumes associated with JIT, this is an ideal solution to the problem.
<b>Batch Level Activities*</b>	Activity (such as setting up machines) where volume varies directly with the number of batches of output but is independent of the number of units in a batch.
<b>Business Process Re-Engineering</b>	Business Process Re-Engineering involves examining business processes and making substantial changes in the day to day operation of the organisation. It involves the redesign of work by changing the activities. A business process

	consists of a collection of activities that are linked together in a coordinated & Sequential manner to achieve goal & objective.
<b>Cost Control</b>	Cost Control implies guidance a reputation of cost by executive action. For this purpose, the executives are provided with some yard stick such as standards or budgets with which the actual costs and performances are compared to ascertain the degree of achievement made. Therefore Cost Control involves continuous comparisons of actual with the standards or budgets to regulate the former. Standards or budgets once set up are not attended during the period or until some mistakes are discovered in standards.
<b>Committed Cost*</b>	Cost arising from prior decisions, which cannot, in the short run, be changed. Committed cost incurrence often stems from strategic decisions concerning capacity with resulting expenditure on plant and facilities. Initial control of committed costs at the decision point is through investment appraisal techniques.
<b>Cost Driver*</b>	Factor influencing the level of cost. Often used in the context of ABC to denote the factor which links activity resource consumption to product outputs, for example the number of purchase orders would be a cost driver for procurement cost.
<b>Cost Management*</b>	Application of management accounting concepts, methods of data collection, analysis and presentation in order to provide the information needed to plan, monitor and control costs.
<b>Cost Reduction</b>	Cost Reduction is the achievement of real and permanent reduction in unit cost of products manufactured. It, therefore, continuously attempts to achieve genuine savings in cost of production distributing, selling and administration. It does not accept a standard or budget as or fined. It rather challenges the standards/budgets continuously to make improvement in them. It attempts to excavate, the potential savings buried in the standards by continuous and planned efforts.
<b>Cost of Appraisal*</b>	Costs incurred in order to ensure that outputs produced meet required quality standards.
<b>Cost of Conformance*</b>	Cost of achieving specified quality standards.
<b>Cost of External Failure*</b>	Cost arising from inadequate quality discovered after the transfer of ownership from supplier to purchaser.

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<b>Cost of Internal Failure*</b>	Costs arising from inadequate quality which are identified before the transfer of ownership from supplier to purchaser.
<b>Cost of Non-Conformance*</b>	Cost of failure to deliver the required standard of quality.
<b>Cost of Prevention*</b>	Costs incurred prior to or during production in order to prevent substandard or defective products or services from being produced.
<b>Computer-Aided Manufacturing</b>	<p>The manufacturing process is carried out by a range of machinery that, together with its concomitant software, comes under the collective heading of computer-aided manufacturing (CAM).</p> <p>Maximum elements of CAM are computer numerical control (CNC) and robotics.</p> <p>CNC machines are programmable machine tools. These are capable of performing a number of machining tasks, e.g. cutting, grinding, moulding, bending etc.</p> <p>A program stores all the existing manufacturing activities and set-up instructions for a particular machine or bank of machines, providing facility of changing its configuration in a matter of seconds via the keyboard; changes to existing configurations and new configurations are easily accommodated. CNC therefore offers great flexibility, and reduces set-up times.</p> <p>Human operators will tire and are error prone. CNC machines are able to repeat the same operation continuously in identical manner, with high accuracy level.</p>
<b>Differentiation Advantage</b>	It occurs when customers perceive that a business unit's product offering (defined to include all attributes relevant to the buying decision) is of higher quality, involves fewer risks and/or outperforms competing product offerings. For example, differentiation may include a firm's ability to deliver goods and services in a timely manner, to produce better quality, to offer the customer a wider range of goods and services, and other factors that provide unique customer value.
<b>Executional Cost Drivers</b>	These drivers capture a firm's operational decisions on how best to employ its resources to achieve its goals and objectives. These cost drivers are determined by management policy, style and culture. How well a firm executes its use of human and physical resources will determine its level of success or failure.

<b>Industry Value Chain</b>	Industry Value Chain refers to the series of activities, which add value to the product supplied to the industry. The industry value chain starts with the value-creating processes of suppliers, who provide the basic raw materials and components. It continues with the value creating processes of different classes of buyers or end-use consumers, and culminates in the disposal and recycling of materials.
<b>Just-in-Time (JIT)*</b>	System whose objective is to produce or to procure products or components as they are required by a customer or for use, rather than for stock.
<b>Just-in-Time Production*</b>	Production system which is driven by demand for finished products, whereby each component on a production line is produced only when needed for the next stage.
<b>Just-in-Time Purchasing*</b>	Purchasing system in which material purchases are contracted so that the receipt and usage of material, to the maximum extent possible, coincide.
<b>Just-in-Time System*</b>	Pull system, which responds to demand, in contrast to a push system, in which stocks act as buffers between the different elements of the system such as purchasing, production and sales.
<b>Kaizen Costing</b>	It focuses on the reduction of waste in the production process, thereby further lowering costs below the initial targets specified during the design phase. Kaizen Costing is a Japanese term for a number of cost reduction steps that can be used subsequent to issuing a new product design to the factory floor. Some of the activities in the Kaizen Costing methodology include the elimination of waste in the production, assembly, and distribution processes, as well as the elimination of work steps in any of these areas.
<b>Low-Cost Advantage</b>	A firm enjoys a relative cost advantage if its total costs are lower than the market average. This relative cost advantage enables a business to do one of the two things; price its product or services lower than its competitors in order to gain market share and still maintain current profitability; or match with the price of competing products or services and increase its profitability.
<b>Life Cycle Costing</b>	Life Cycle Costing is different to traditional cost accounting system which report cost object profitability on a calendar basis i.e. monthly, quarterly and annually. Life Cycle Costing involves tracing cost and revenues on a product by product basis over several calendar periods. Costs and revenue can be analysed by time period, but the emphasis

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	is on cost revenue accumulation over the entire life cycle of each product.
<b>MRP- II</b>	<p>When the scope of MRP-1 is developed further that includes</p> <ul style="list-style-type: none"> <li>- Planning of Raw Material;</li> <li>- Planning of Component &amp; Sub- Assemblies;</li> <li>- Compute the Other Resources e.g. Machine or Labour Capacity;</li> <li>- To create a fully integrated Plan for Management</li> </ul> <p>then it is known as Manufacturing resources planning (MRP – 2).</p> <p>MRP-II (also written MRP-2) adds the MRP schedule into a capacity planning system and then builds the information into a production schedule. It is also seen as a link between strategic planning and manufacturing control.</p>
<b>Management Accounting*</b>	<p>Management accounting is the application of the principles of accounting and financial management to create, protect, preserve and increase value for the stakeholders of for-profit and not-for-profit enterprises in the public and private sectors. Management accounting is an integral part of management. It requires the identification, generation, presentation, interpretation and use of relevant information to:</p> <ul style="list-style-type: none"> <li>- Inform strategic decisions and formulate business strategy</li> <li>- Plan long, medium and short-run operations</li> <li>- Determine capital structure and fund that structure</li> <li>- Design reward strategies for executives and shareholders</li> <li>- Inform operational decisions</li> <li>- Control operations and ensure the efficient use of resources</li> <li>- Measure and report financial and nonfinancial performance to management and other stakeholders</li> <li>- Safeguard tangible and intangible assets</li> <li>- Implement corporate governance procedures, risk management and internal controls.</li> </ul>
<b>Material Requirements Planning (MRP) *</b>	System that converts a production schedule into a listing of the materials and components required to meet that schedule, so that adequate stock levels are maintained and items are available when needed.

<b>Non-Value-Added Activities (NVA)</b>	The Non-Value-Added Activities (NVA) represents work that is not valued by the external or internal customer. NVA activities do not improve the quality or function of a product or service, but they can adversely affect costs and prices. Non-value added activities create waste, result in delay of some sort, add costs to the products or services and for which the customer is not willing to pay. Moving materials and machine set up for a production run are examples of NVA activities.
<b>Product Life Cycle</b>	Each product has a life cycle. The life cycle of a product vary from a few months to several years. Product life cycle is thus a pattern of expenditure, sales level, revenue and profit over the period from new idea generation to the deletion of product from product range. The life cycle of a product consists of four phases viz., Introduction; Growth; Maturity; Saturation and Decline.
<b>Penetration Pricing Strategy</b>	Penetration Pricing is the strategy of entering the market with a low initial price so that a greater share of the market can be captured. The penetration strategy is used when an elite market does not exist and demand seems to be elastic over the entire demand curve, even during early stages of product introduction. High price elasticity of demand is probably the most important reason for adopting a penetration strategy. The penetration strategy is also used to discourage competitors from entering the market.
<b>Quality</b>	It is a measure of goodness to understand how a product meets its specifications. ISO standard defines quality as ‘the totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs’. When the expression ‘quality’ is used, we usually think terms of an excellent product or service that fulfills or exceeds our expectations. These expectations are based on the intended use and the selling price. When a product surpasses our expectations we consider that quality. Thus, it is somewhat of an intangible based on perception.
<b>Quality Assurance</b>	It deals with the present, and concerns the putting in place of systems to prevent defects from occurring.
<b>Quality Control</b>	It is concerned with the past, and deals with data obtained from previous production which allow action to be taken to stop the production of defective units.
<b>Quality Cost</b>	Cost of performing the activities to check failure in meeting

	the quality specification. The 'cost of quality' isn't the price of creating a quality product or service. It's the cost of not creating a quality product or service. Every time work is redone, the cost of quality increases.
<b>Quality Management</b>	It is concerned with the future, and manages people in a process of continuous improvement to the products and services offered by the organisation.
<b>Synchronous Manufacturing</b>	'Synchronous Manufacturing' has been defined as 'an all-encompassing manufacturing management philosophy that includes a consistent set of principles, procedures, and techniques where every action is evaluated in terms of the common global goal of the organisation.
<b>Structural Cost Drivers</b>	Structural Cost Drivers consist of organisational factors that determine the economic structure driving the cost of a firm's products. These cost drivers reflect a firm's long-term decisions, which position the firm in its industry and marketplace.
<b>Skimming Pricing Strategy</b>	Skimming Pricing is the strategy of establishing a high initial price for a product with a view to 'skimming the cream off the market' at the upper end of the demand curve. It is accompanied by heavy expenditure on promotion. A skimming strategy may be recommended when the nature of demand is uncertain, when a company has expended large sums of money on research and development for a new product, when the competition is expected to develop and market a similar product in the near future, or when the product is so innovative that the market is expected to mature very slowly.
<b>Six-Sigma Accuracy</b>	The sigma accuracy means the process is 99.99998% accurate. That is the process will / can produce only 0.002 defects per million. This is the structural meaning of six-sigma. In quality practice, six-sigma means 3.4 parts per million.
<b>Throughput*</b>	Throughput term defined, in work by Goldratt, 'as sales minus material and component costs. Similar to contribution except material is considered the only variable cost'. Goldratt argues that labour costs should be treated as fixed'. In Goldratt's analysis 'operating expense is all non-material costs' and 'inventory cost is defined as the cost of assets employed'.
<b>Throughput</b>	Variable cost accounting presentation based on the definition

<b>Accounting (TA) *</b>	of throughput (sales minus material and component costs). Sometimes referred to as super variable costing because only material costs are treated as variable.
<b>Target Costing</b>	<p>Target Costing has been described as a process that occurs in a competitive environment, in which cost minimization is an important component of profitability. This newer approach of product costing may take into account initial design and engineering costs, as well as manufacturing costs, plus the costs of distribution, sales and services.</p> <p>It can be defined as ‘a structured approach to determining the cost at which a proposed product with specified functionality and quality must be produced, to generate a desired level of profitability at its anticipated selling price’.</p>
<b>Throughput Ratios*</b>	<p>Several ratios were defined by Galloway and Waldron based on the definition of throughput. The TA (throughput accounting) ratio is:</p> $\frac{\text{Throughput Per Bottleneck Minute}}{\text{Factory Cost Per Bottleneck Minute}}$ <p>[Note: Galloway and Waldron define factory cost in the same way that Goldratt defines operating expense. See throughput]</p> <p>If the TA ratio is greater than 1 the product in question is “profitable” because, if all capacity were devoted to that product, the throughput generated would exceed the total factory cost. If there was a bottleneck products could be ranked by a variant of the TA ratio (although the ranking is the same as that derived by the use of throughput per bottleneck minute). Other performance ratios suggested include:</p> $\frac{\text{Throughput}}{\text{Labour Cost}} \text{ and } \frac{\text{Throughput}}{\text{Material Cost}}$
<b>Theory of Constraints (TOC) *</b>	Procedure based on identifying bottlenecks (constraints), maximising their use, subordinating other facilities to the demands of the bottleneck facilities, alleviating bottlenecks and re-evaluating the whole system.

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<b>Total Quality Management (TQM)</b>	<p>TQM is a management approach for an organization, centered on quality, based on the participation of all its members and aiming at long-term success through customer satisfaction, and benefits to all members of the organization and to society.</p> <p>CIMA defines 'Total Quality Management' as integrated and comprehensive system of planning and controlling all business functions so that products or services are produced which meet or exceed customer expectations. TQM is a philosophy of business behaviour, embracing principles such as employee involvement, continuous improvement at all levels and customer focus, as well as being a collection of related techniques aimed at improving quality such as full documentation of activities, clear goal-setting and performance measurement from the customer perspective.</p>
<b>Throughput per Bottleneck Minute*</b>	Method of ranking products that share the same (bottleneck) facility. Very similar to the use of contribution per unit of limiting factor.
<b>The Plan-Do-Study-Act Cycle</b>	The 'Plan – Do – Study – Act' Cycle describes the activities a company needs to perform in order to incorporate continuous improvement in its operation. This cycle, is also referred to as the Shewhart Cycle or the Deming Wheel. The circular nature of this cycle shows that continuous improvement is a never-ending process.
<b>Value Analysis*</b>	Value Analysis is a systematic interdisciplinary examination of factors affecting the cost of a product or service in order to devise means of achieving the specified purpose at the required standard of quality and reliability at the target cost.
<b>Value Chain</b>	<p>Porter described the Value Chain as 'internal processes or activities a company performs to design, produce, market, deliver and support its product'. He further stated that 'a firm's value chain and the way it performs individual activities are a reflection of its history, its strategy, its approach of implementing its strategy, and the underlying economics of the activities themselves'.</p> <p>John Shank and V. Govindarajan described the value chain in broader terms. According to them 'the value chain for any firm is the value-creating activities all the way from basic raw material sources from component suppliers through to the ultimate end-use product delivered into the final consumer's hands'. This description views the firm as part of an overall chain of value-creating processes.</p>

<b>Value Engineering (VE)</b>	Value Engineering involves searching for opportunities to modify the design of each component or part of a product to reduce cost, but without reducing functionality or quality of the product.
<b>Value-Added Activities (VA)</b>	The Value-Added Activities are those activities which are indispensable in order to complete the process. The customers are usually willing to pay (in some way) for these services. For example polishing furniture by a manufacturer dealing in furniture is a value added activity.

*(\*)Source - CIMA's Official Terminology*

## SECTION - A

### The Impact of Changing Environment on Cost and Management Accounting

#### Question-1

*How has the composition of manufacturing costs changed during recent years? How has this change affected the design of cost accounting systems?*

 Answer

Traditionally, manufacturing companies classified the manufacturing costs to be allocated to the products into (a) direct materials, (b) direct labour and (c) indirect manufacturing costs. In the present day context, characterised by intensive global competition, large scale automation of manufacturing process, computerization and product diversification to cater to the changing consumer tastes and preferences has forced companies to refine their costing systems to provide better measurement of the overhead costs used by different cost objects. Accordingly, manufacturing costs are classified into three broad categories as under:

- (i) *Direct cost:* As many total costs relating to cost objects as feasible are classified into direct cost. The objective is to trace as many costs as possible in to direct and to reduce the amount of costs classified into indirect because the greater the proportion of direct costs the greater the accuracy of the cost system.
- (ii) *Indirect cost pools:* Increase the number of indirect cost pools so that each of these pools is more homogeneous. In a homogeneous cost pool, all the costs will have the same cause-and-effect relationship with the cost allocation base.
- (iii) Use cost-and-effect criterion for identifying the cost allocation base for each indirect cost pool.

The change in the classification of manufacturing costs as above has lead to the development of Activity Based Costing (ABC). Activity Based Costing refines a costing system by focusing on individual activities as the fundamental cost objects. An activity is an event, task or unit of work with a specified purpose as for example, designing, set up, etc. ABC system calculates the costs of individual activities and assigns costs to cost objects such as products or services on the basis of the activities consumed to produce the product or provide the service.

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## Total Quality Management (TQM)

### Question-2

Write a short note on 'Quality Cost'.



Cost of performing the activities to check failure in meeting the quality specification. *The "cost of quality" isn't the price of creating a quality product or service. It's the cost of not creating a quality product or service.* Every time work is redone, the cost of quality increases. Obvious examples include:

- (i) The reworking of a manufactured item.
- (ii) The retesting of an assembly.
- (iii) The rebuilding of a tool.
- (iv) The correction of a bank statement.
- (v) The reworking of a service, such as the reprocessing of a loan operation or the replacement of a food order in a restaurant.

In short, any cost that would not have been expended if quality were perfect contributes to the cost of quality.

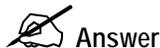
Quality costs are the total of the cost incurred by;

- (i) Investing in the prevention of nonconformance to requirements.
- (ii) Appraising a product or service for conformance to requirements.
- (iii) Failing to meet requirements, which can be internal failure or external failure.

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### Question-3

Define "Quality" and explain its important dimensions.



It is a measure of goodness to understand how a product meets its specifications. ISO standard defines quality as *"the totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs."*

When the expression "quality" is used, we usually think terms of an excellent product or service that fulfills or exceeds our expectations. These expectations are based on the intended use and the selling price. When a product surpasses our expectations we consider that quality. Thus, it is somewhat of an intangible based on perception.

Quality has nine important dimensions demonstrated in the table below:

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Dimension	Meaning and Example
Performance	Primary product characteristic, such as the brightness of the picture
Features	Secondary characteristic, added features, such as remote control
Conformance	Meeting specifications or industry standards, workmanship
Reliability	Consistency of performance over time, average time for the unit to fail
Durability	Useful life, includes repair
Service	Resolution of problems and complaints, ease of repair
Response	Human-to- human interface, such as the courtesy of the dealer
Aesthetics	Sensory characteristics, such as exterior finish
Reputation	Past performance and other intangibles, such as being ranked first

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### Question-4

Give 5 examples of Prevention Costs, Appraisal Costs, Internal Failure Costs, and External Failure Costs.

 Answer

Prevention Costs	Appraisal Costs	Internal Failure Costs	External Failure Costs
Quality Engineering	Inspection	Scrap	Revenue Loss
Quality Training	Product Acceptance	Rework	Warranties
Quality Audits	Packaging Inspection	Re-Inspection	Discount Due to Defects
Design Review	Field Testing	Re-Testing	Product Liability
Quality Circles etc	Continuing Supplier Verification etc	Repair etc	Warranty etc

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### Question-5

Explain four P's of quality improvement principles.

 Answer

The Four P's quality improvement principles are as below:

- (i) **People:** It will quickly become apparent that *some individuals are not ideally suited to the participatory process*. Lack of enthusiasm will be apparent from a generally negative

approach. Where these individuals are charged with the responsibility for driving group success then progress will be slow or negligible

- (ii) **Process:** It is essential to approach *problem-solving practically* and to regard *the formal process* as a system designed to prevent participants from jumping to conclusions.
- (iii) **Problem:** Problems need to be approached in *bite-sized chunks*, with teams tackling solvable problems with a direct economic impact, allowing for immediate feedback together with recognition of the contribution made by individual participants.
- (iv) **Preparation:** *Courses on creative thinking* and *statistical processes* are needed in order to give participants a greater appreciation of the diversity of the process. This training must quickly be extended beyond the immediate accounting circle to include employees at supervisory levels and below who are involved at the data input stage.

**Question-6**

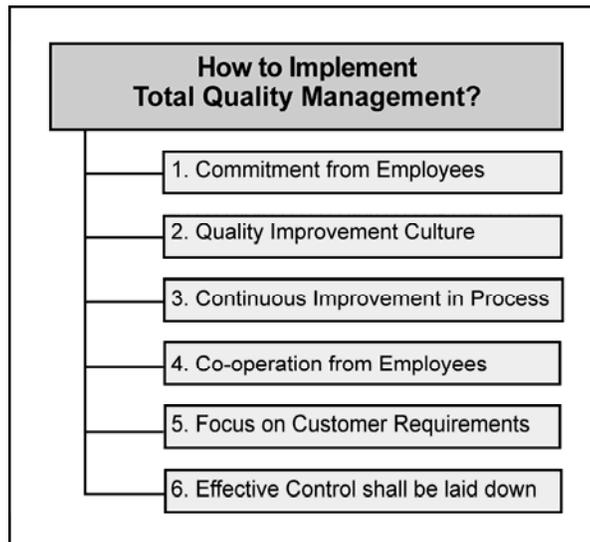
*What are the essential requirements for successful implementation of TQM?*

*Or*

*What are Six C's of TQM?*

 **Answer**

The Six Cs for successful implementation of a Total Quality Management (TQM) process is depicted as follows:



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- (i) **Commitment:** Quality improvement must be everyone's job. Clear commitment from the top management, steps necessary to provide an environment for changing attitudes and breaking down barriers to quality improvement must be provided. Support and training for this must be extended.
  - (ii) **Culture:** Proper training must be given to effect changes in culture and attitude.
  - (iii) **Continuous Improvement:** Recognition of room for improvement continually as a process, and not merely a one-off programme.
  - (iv) **Cooperation:** Must be ensured by involving employees by resorting to mutually agreeable improvement strategies and associated performance measures.
  - (v) **Customer Focus:** Perfect service with zero defectives with satisfaction to end user whether external customer or internal customer.
  - (vi) **Control:** Documentation, procedures and awareness of current practices ensure checking deviation from the intended course of implementation.
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### Question-7

List out the remedies available for difficulties experienced during implementation of PRAISE.

 Answer

Remedies available for difficulties experienced in each step available during implementation of praise:

Step	Activity	Remedies
(i)	Problem Identification	✓ Participative approaches like brainstorming, multi-voting, panel discussion. ✓ Quantification and precise definition of problem.
(ii)	Ranking	✓ Participative approach. ✓ Subordination of individual to group interest.
(iii)	Analysis	✓ Lateral thinking brainstorming.
(iv)	Innovation	✓ Systematic evaluation of all aspects of each strategy.
(v)	Solution	✓ Effective internal communication. ✓ Training of personnel and managers. ✓ Participative approach.
(vi)	Evaluation	✓ Effective control system to track actual feedback system.

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**Question-8**

*Discuss the benefits accruing from the implementation of a Total Quality Management programme in an organization.*

 **Answer**

The benefits accruing from the implementation of a Total Quality Management programme in an organisation are:

- (i) There will be increased awareness of quality culture in the organization.
  - (ii) It will lead to commitment to continuous improvement.
  - (iii) It will focus on customer satisfaction.
  - (iv) A greater emphasis on team work will be achieved.
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**Question-9**

*What are the universal beliefs in respect of TQM?*

 **Answer**

Following are the universal Total Quality Management beliefs:

- (i) Owner / customer satisfaction is the measure of quality.
  - (ii) Everyone is an owner/customer.
  - (iii) Quality improvement must be continuous.
  - (iv) Analysis of the processes is the key to quality improvement.
  - (v) Measurement, a skilled use of analytical tools, and employee involvement are critical sources of quality improvement ideas and innovations.
  - (vi) Sustained total quality management is not possible without active, visible, consistent, and enabling leadership by managers at all levels.
  - (vii) It is essential to continuously improve the quality of products and services that we provide to our owners/customers.
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**Question-10**

*Describe Deming's 14 points.*

 **Answer**

**Deming "14 points"**

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1. "Create constancy of purpose towards improvement". Replace short-term reaction with long-term planning.	2. "Adopt the new philosophy". The implication is that management should actually adopt his philosophy, rather than merely expect the workforce to do so.
3. "Cease dependence on inspection". If variation is reduced, there is no need to inspect manufactured items for defects, because there won't be any.	4. "Move towards a single supplier for any one item." Multiple suppliers mean variation between feedstock.
5. "Improve constantly and forever". Constantly strive to reduce variation.	6. "Institute training on the job". If people are inadequately trained, they will not all work the same way, and this will introduce variation.
7. "Institute leadership". Deming makes a distinction between leadership and mere supervision. The latter is quota and target-based.	8. "Drive out fear". Deming sees management by fear as counter-productive in the long term, because it prevents workers from acting in the organisation's best interests.
9. "Break down barriers between departments". Another idea central to TQM is the concept of the 'internal customer', that each department serves not the management, but the other departments that use its outputs.	10. "Eliminate slogans". Another central TQM idea is that it's not people who make most mistakes - it's the process they are working within. Harassing the workforce without improving the processes they use is counter-productive.
11. "Eliminate management by objectives". Deming saw production targets as encouraging the delivery of poor-quality goods.	12. "Remove barriers to pride of workmanship". Many of the other problems outlined reduce worker satisfaction.
13. "Institute education and self-improvement".	14. "The transformation is everyone's job".

### Question-11

Write a note on the 'Plan – Do – Study – Act' cycle.

Or

Write a note on 'Shewhart' cycle.

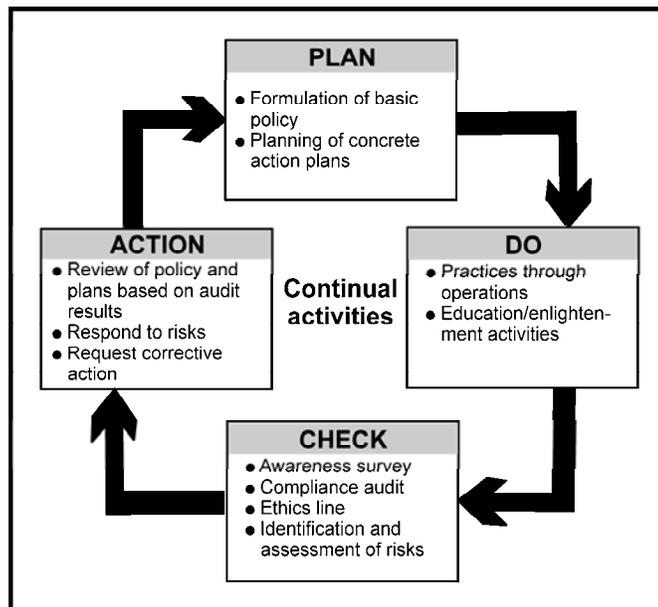
Or

Write a note on 'Deming Wheel'.

 Answer

The Plan – Do – Study – Act (PDSA) Cycle describes the activities a company needs to perform in order to incorporate continuous improvement in its operation. This cycle, is also referred to as the *Shewhart cycle or the Deming wheel*. The circular nature of this cycle shows that continuous improvement is a never-ending process. Let’s look at the specific steps in the cycle.

- (i) **Plan:** The first step in the PDSA cycle is to plan. Managers must evaluate the current process and make plans based on any problems they find. They need to document all current procedures, collect data, and identify problems. This information should then be studied and used to develop a plan for improvement as well as specific measures to evaluate performance.
- (ii) **Do:** The next step in the cycle is implementing the plan (do). During the implementation process managers should document all changes made and collect data for evaluation.
- (iii) **Study / Check:** The third step is to study the data collected in the previous phase. The data are evaluated to see whether the plan is achieving the goals established in the plan phase.
- (iv) **Act:** The last phase of the cycle is to act on the basis of the results of the first three phases. The best way to accomplish this is to communicate the results to other members in the company and then implement the new procedure if it has been successful.



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Note that this is a cycle; the next step is to plan again. After we have acted, we need to continue evaluating the process, planning, and repeating the cycle again.

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### Question-12

*Write a note on Six Sigma.*

 **Answer**

Continuous improvement can be brought into the organisational culture by introducing continuously changing planned targets. One such target can be six-sigma accuracy. The sigma accuracy means the process is 99.999998% accurate. That is the process will/can produce only 0.002 defects per million. This is the structural meaning of six-sigma. In quality practice, six-sigma means 3.4 parts per million.

Six sigma is the statistical measure used to ensure quality of products and services. The six sigma academy has developed a break through strategy consisting of measure, analyze, improve and control, that allows companies to make exceptional bottom-line improvements.

In addition to the material and labour savings, which flow directly to the bottom line, a company engaged in six sigma can expect to see:

- (i) Improved customer satisfaction.
- (ii) Reduction cycle time.
- (iii) Increased productivity.
- (iv) Reduction in total defect.
- (v) Improved process flow.

**Six Sigma Capability Chart**

Sigma	Parts per Million
Six Sigma	3.4 Defects per Million
Five Sigma	233 Defects per Million
Four Sigma	6,120 Defects per Million
Three Sigma	66,807 Defects per Million
Two Sigma	3,08,537 Defects per Million
One Sigma	6,90,000 Defects per Million

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### Question-13

*Write a note on "Criticisms of Total Quality Management"*

 Answer

Some authors, notably Carlzon (1987), Albrecht (1985) and Albrecht and Zemke (1988) have criticised the direction that TQM implementations have tended to take in practice, in particular.

- the focus on documentation of process and ill-measurable outcomes;
- the emphasis on quality assurance rather than improvement; and
- an internal focus which is at odds with the alleged customer orientation.

Carlzon has revived the customer focus with an emphasis on total employee involvement (TEI) culminating in the empowerment of the 'front-line' of customer service troops. The main features of his empowerment thrust has been :

- loyalty to the vision of the company through the pursuit of tough, visible goals;
- recognition of satisfied customers and motivated employees as the true assets of a company;
- delegation of decision-making to the point of responsibility by eliminating hierarchical tiers of authority to allow direct and speedy response to customer needs; and
- decentralisation of management to make best use of the creative energy of the workforce.

Albrecht suggest that TQM may not be appropriate for service based industries, because the standards-based approach of 'industry best practice' ignores the culture of organisations. He recommends a move towards TQS (total quality service), which is more customer oriented and creates an environment to promote enthusiasm and commitment. Albrecht suggests that poor service is associated with sloppy procedures, errors, inaccuracies and oversights and poor co-ordination, all of which represents improvement opportunities which can be achieved through tighter controls.

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## Activity Based Cost Management

### Question-14

*What is activity based costing?*

 Answer

Activity Based Costing is an accounting methodology that assigns costs to activities rather than products or services. This enables resources & overhead costs to be more accurately assigned to products & services that consume them.

CIMA defines '*Activity Based Costing*' as *an approach to the costing and monitoring of activities which involves tracing resource consumption and costing final outputs. Resources*

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*are assigned to activities, and activities to cost objects based on consumption estimates. The latter utilise cost drivers to attach activity costs to outputs."*

### Question-15

*Explain the concept of activity based costing. How ABC system supports corporate strategy?*



### Answer

*"ABC is an accounting methodology that assigns costs to activities rather than products and services. This enables resources and overhead costs to be more accurately assigned to products and services that consume them when compared to traditional methods where either labour or machine hrs are considered as absorption basis over cost centres."*

In order to correctly associate costs with products and services, ABC assigns cost to activities based on their resources . It then assigns cost to 'Cost objects', such as products and customers, based on their use of activities. ABC can track the flow of activities in organization by creating a link between the activity and the cost objects. ABC supports corporate strategy in many ways such as:

- (i) ABC system can effectively support the management by furnishing data, at the operational level and strategic level. Accurate product costing will help the management to compare the profits of various customers, product lines and to decide on price strategy etc.
- (ii) Information generated by ABC system can also encourage management to redesign the products.
- (iii) ABC system can change the method of evaluation of new process technologies, to reduce setup times, rationalization of plant lay out in order to reduce or lower material handling cost, improve quality etc.
- (iv) ABC system will report on the resource spending.
- (v) ABC analysis helps managers focus their attention and energy on improving activities and the actions allow the insights from ABC to be translated into increased profits.
- (vi) Performance base accurate feedback can be provided to cost centre managers.
- (vii) Accurate information on product costs enables better decisions to be made on pricing, marketing, product design and product mix.

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### Question-16

*Why are conventional product costing systems more likely to distort product costs in highly automated plants? How do activity-based costing systems deal with such a situation?*

 Answer

The conventional product cost system was in vogue when companies manufactured narrow range of products, overhead costs were relatively small and distortions arising from inappropriate overhead allocations were not significant. It used volume measures like direct labour hours or machine hours for charging overhead costs to products. In the case of a company using highly automated plant, direct labour is a small fraction of cost when compared with overheads (because of higher amount of depreciation). In case where such a company is multi product, overheads which are large in proportion to direct labour are influenced by number of set up, inspection, number of purchases etc. In these circumstances, the volume based method of recovery of overheads is no longer appropriate and such a measure will report inaccurate product costs. Hence, the traditional system of costing was found to over cost high volume products and under cost low volume products. Activity Based Costing (ABC) system aims at refining the costing system used in automated plants in the following manner:

- (i) ABC systems trace more costs as direct costs.
  - (ii) ABC systems create homogeneous cost pools linked to different activities.
  - (iii) For each activity cost pool, ABC systems seek a cost allocation base that has a cause-and-effect relationship with costs in the cost pool.
- 

**Question-17**

*Write the factors prompting the development of ABC system.*

 Answer

Factors prompting the development of ABC system include:

- (i) Growing overhead costs because of increasingly automated production.
  - (ii) Increasing market competition which necessitated more accurate product costs.
  - (iii) Increasing product diversity to secure economies of scope & increased market share.
  - (iv) Decreasing costs of information processing because of continual improvements and increasing application of information technology.
- 

**Question-18**

*State main advantages of Activity Based Costing.*

 Answer

The main advantages of using Activity Based Costing are:

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- (i) More accurate costing of products/services, customers, SKUs, distribution channels.
  - (ii) Better understanding overhead.
  - (iii) Utilizes unit cost rather than just total cost.
  - (iv) Integrates well with Six Sigma and other continuous improvement programs.
  - (v) Makes visible waste and non-value added.
  - (vi) Supports performance management and scorecards.
  - (vii) Enables costing of processes, supply chains, and value streams.
  - (viii) Activity Based Costing mirrors way work is done.
  - (ix) Facilitates benchmarking.
- 

### Question-19

*Explain - "ABC: A Decision Making Tool".*

 Answer

It is a useful tool for many of the management decisions facing companies today. It can bring a picture of the operation to light that may not be obvious through other analysis tools. Specifically, ABC is useful in analyzing specific segments of an organization. This might include a market line, a group of products (even a single product), a customer, or an employee. The ABC is implemented in following decisions:

- (i) ABC is a complement to total quality management (TQM). It provides quantitative data that can track the financial impact of improvements implemented as part of the TQM initiative. Some have even suggested that ABC is the most important concept introduced since TQM..
- (ii) Wholesale distributors can gain significant advantage in the decision-making process through implementation of ABC concepts. The expansion of line offerings has brought about difficult decisions for the distributor..
- (iii) Other decisions that can be assisted by ABC include facility and resource expansion. Often the basis for relocation or opening of a new distribution center is based on cost associations. The ABC model can identify the specific cost elements being targeted, providing a much clearer picture from which management can act.
- (iv) Decision support for human resources can be augmented by ABC. Where activity, and therefore cost, can be associated to an individual, new levels of financial performance can be determined.
- (v) Companies who wish to determine price based on cost plus markup basis find ABC method of costing very relevant and are able to determine competitive prices for their products.

- (vi) Using Traditional absorption costing, overheads may get distributed equally across all product lines. ABC traces costs back to the activity and the consumption of resources by each product. Thus, product line profitability can be determined in more realistic terms.
- (vii) Other areas where ABC system can be relevant include market, make or buy decisions, transfer pricing, plant close – down decisions, evaluation of offshore production or outsourcing a process, capital investment decisions, etc.

In summary, activity-based costing is a management decision-making tool. By associating cost to the activity, a clear relationship can be established between sources of activity demand and the related costs. This association can benefit the distributor in determining where costs are being incurred, what is initiating the costs and where to apply efforts to curb inflationary costs. This can be of particular value in tracking new products or customers. It can also provide tracking of logistics costs, one of the fastest growing areas of expense to the distribution operation.

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#### Question-20

*Explain which features of the Service organisations may create problems for the application of activity-based costing.*

 Answer

The following may create problem for adoption of ABC system in service organisation –

- (i) *Facility sustaining costs* (such as property, rents etc.) represent a significant portion of total costs and may only be avoidable if the organisation ceases business. *It may be impossible to establish appropriate cost drivers.*
  - (ii) It is often difficult to define products where they are of *intangible nature*. *Cost objects can therefore be difficult to specify.*
  - (iii) Many service organisations have *not previously had a costing system* and much of the information required to set up a ABC system will be non-existent. Therefore *introduction of ABC may be expensive.*
- 

#### Question-21

*What is the fundamental difference between Activity Based Costing System (ABC) and Traditional Costing System? Why more and more organisations in both the manufacturing and non-manufacturing industries are adopting ABC?*

 Answer

In the traditional system of assigning manufacturing overheads, overheads are first allocated and apportioned to cost centres (production and support service cost centres) and then absorbed to cost objects (e.g. products). Under ABC, overheads are first assigned to activities or activity pools (group of activities) and then they are assigned to cost objects. Thus, ABC is a refinement over the traditional costing system. Usually cost centres include a series of different activities. If different products create different demands on those activities, the traditional costing system fails to determine the product cost accurately. In that situation, it becomes necessary to use different rates for different activities or activity pools.

The following are the reasons for adoption of ABC by manufacturing and non-manufacturing industries:

- (i) Fierce competitive pressure has resulted in shrinking profit margin. ABC helps to estimate cost of individual product or service more accurately. This helps to formulate appropriate marketing / corporate strategy.
- (ii) There is product and customer proliferation. Demand on resources by products / customers differ among product / customers. Therefore, product / customer profitability can be measured reasonably accurately, only if consumption of resources can be traced to each individual product / customer.
- (iii) New production techniques have resulted in the increase of the proportion of support service costs in the total cost of delivering value to customers. ABC improves the accuracy of accounting for support service costs.
- (iv) The costs associated with bad decisions have increased substantially.
- (v) Reduction in the cost of data processing has reduced the cost of tracking resources consumption to large number of activities.

**Question-22**

*Point out the differences between activity based costing and traditional absorption costing.*

 Answer

The points of differences between activity based costing and traditional absorption costing can be enumerated below:

Activity Based Costing	Traditional Absorption Costing
(i) Overheads are related to activities and grouped into activity cost pools.	(i) Overheads are related to cost centers / departments.

(ii) Activities are classified as – (i) Unit Level, (ii) Batch Level, (iii) Product Level and (iv) Facility Level activities.	(ii) Only (i) Unit Level (Variable) and (ii) Facility Level (Fixed) activities are identified.
(iii) Costs are related to activities and hence are more realistic.	(iii) Costs are related to cost centers and hence not realistic of cost behaviour.
(iv) Activity-wise cost drivers are determined.	(iv) Time (Hours) are assumed to be the only cost driver governing costs in all departments.
(v) Activity-wise recovery rates are determined and there is no concept of a single overhead recovery rate.	(v) Either multiple overhead recovery rate (for each department) or a single overhead recovery rate may be determined for absorbing overheads.
(vi) Cost are assigned to cost objects, e.g. customers, products, services, departments, etc.	(vi) Costs are assigned to Cost Units i.e. to products, or jobs or hours.
(vii) Essential activities can be simplified and unnecessary activities can be eliminated. Thus the corresponding costs are also reduced / minimized. Hence ABC aids cost control.	(vii) Cost Centers / departments cannot be eliminated. Hence not suitable for cost control.

**Question-23**

*State Benefits of Activity Based Cost Management.*

 **Answer**

Benefits of Activity Based Cost Management

- (i) Provision of excellent basis and focus for cost reduction.
- (ii) Provides operational management with a clear view of HOW to implement an Activity Based budget.
- (iii) Provision of clear understanding of the underlying causes of business processing costs.
- (iv) Provision of excellent basis for effectiveness of management decision making.
- (v) Identification of key process waste elements, permit management prioritisation and leverage of key resources.

**Question-24**

*What is difference between ABC and ABM?*

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### Answer

The ABC refers to the technique for determining the cost of activities and the output that those activities produce. It is the logical distribution of overhead i.e. overhead should be distributed on the consumption of resources consumed by goods and services. The aim of ABC is to generate improved cost data for use in managing a company's activities.

The ABM is a much broader concept. It refers to the management philosophy that focuses on the planning, execution and measurement of activities as the key to competitive advantage.

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### Question-25

*What are the key elements of Activity Based Budgeting (ABB)?*

### Answer

The key elements of ABB are:

- (i) Type of work/activity to be performed;
  - (ii) Quantity of work/activity to be performed; and
  - (iii) Cost of work/activity to be performed.
- 

### Question-26

*Write a short note on 'Batch Level Activities'.*

### Answer

The cost of some activities (mainly manufacturing support activities) is driven by the number of batches of units produced. Examples of this are:

- (i) Material Ordering – Where an order is placed for every batch of production.
  - (ii) Machine Set-up Costs – Where machines need resetting between each different batch of production.
  - (iii) Inspection of Products – Where the first item in every batch is inspected rather than every 100th item quoted above.
- 

### Question-27

*Give two examples for each of the following categories in activity based costing:*

- (i) Unit level activities
- (ii) Batch level activities

(iii) *Product level activities*

(iv) *Facility level activities*

 **Answer**

*Examples:*

- |                             |      |  |
|-----------------------------|------|--|
| (i) Unit Level Activities   | ---- | (i) Use of indirect materials<br>(ii) Inspection or testing of every item produced<br>(iii) Indirect consumables                                     |
| (ii) Batch Level Activities | ---- | (i) Material ordering<br>(ii) Machine set up costs<br>(iii) Inspection of products—like first item of every batch                                    |
| (iii) Product Level         | ---- | (i) Designing the product<br>(ii) Producing parts to a certain specification<br>(iii) Advertising costs, if advertisement is for individual products |
| (iv) Facility Level         | ---- | (i) Maintenance of buildings<br>(ii) Plant security  |
- 

**Question-28**

*Differentiate between 'Value-added' and 'Non-value-added' activities in the context of Activity based costing. Give examples of Value-added and Non-value-added activities.*

 **Answer**

A value added activity is an activity that *customers perceive as adding usefulness to the product or service they purchase*. In other words, it is an activity that, if eliminated, will reduce the actual utility or usefulness which customers obtain from using the product or service. For example, painting a car in a company manufacturing cars or a computer manufacturing company making computers with preloaded software.

A non-value added activity is an activity where *there is an opportunity of cost reduction without reducing the product's service potential to the customer*. In other words, it is an activity that, if eliminated, will not reduce the actual or perceived value that customers obtain by using the product or service. For example, storage and moving of raw materials, reworking or repairing of products, etc.

Value-added activities enhance the value of products and services in the eyes of the organisation's customers while meeting its own goals. Non-value added activities on the other hand do not contribute to customer-perceived value.

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## Target Costing

### Question-29

*What is Target Costing? It is said that implementation of the target costing technique requires intensive marketing research. Explain why intensive marketing research is required to implement target costing technique.*



Answer

Target cost is the difference between estimated selling price of a proposed product with specified functionality and quality and the target margin. This is a cost management technique that aims to produce and sell products that will ensure the target margin. It is an integral part of the product design. While designing the product, the company needs to understand what value target customers will assign to different attributes and different aspects of quality. This requires use of techniques like value engineering and value analysis. Intensive marketing research is required to understand customer preferences and the value they assign to each attribute and quality parameter. This insight is required to be developed must before the product is introduced. The company plays within the space between the maximum attributes and quality that the company can offer and the minimum acceptable to target customers. Therefore in absence of intensive marketing research, the target costing technique cannot be used effectively.

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### Question-30

*What is target costing? It is said that target costing fosters team work within the organisation. Explain how target costing creates an environment in which team work fosters.*



Answer

Target cost is the difference between the estimated selling price of a proposed product with specified functionality and quality and target margin. This is a cost management technique that aims to produce and sell products that will ensure the target margin. It is an integral part of the product design. While designing the product the company allocates value and cost to different attributes and quality. Therefore, they use the technique of value engineering and value analysis. The target cost is achieved by assigning cost reduction targets to different operations that are involved in the production process. Eventually, all operations do not

achieve the cost reduction targets, but the overall cost reduction target is achieved through team work. Therefore, it is said that target costing fosters team work.

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**Question-31**

*Discuss, how target costing may assist a company in controlling costs and pricing of products.*

 **Answer**

Target costing may assist control of costs and pricing of product as under:

- (i) Target costing considers the price that ought to be charged by a company to achieve a given market share.
  - (ii) Target costing should take life cycle costs in to consideration.
  - (iii) If there is a gap between the target cost and expected cost, ways and means of reducing or eliminating it can be explored.
  - (iv) The target cost may be used for controlling costs by comparison.
- 

**Question-32**

*State any 5 advantages of "Target Costing".*

 **Answer**

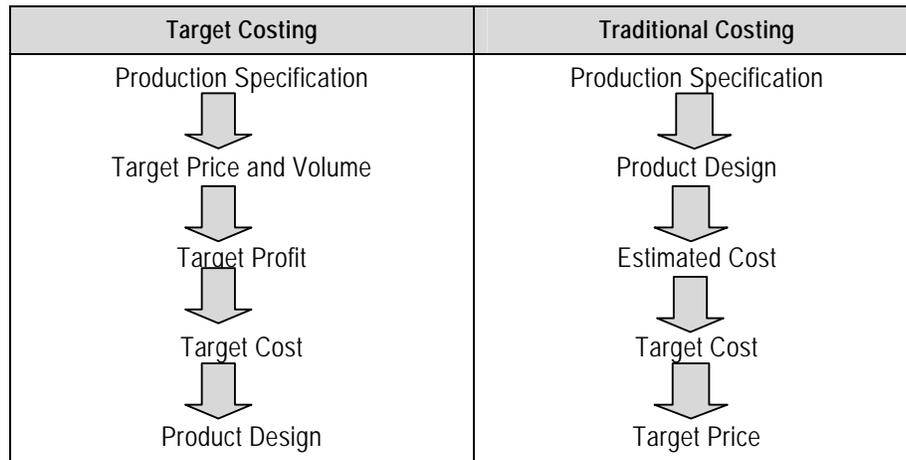
Advantages of "Target Costing are as under:

- (i) Target costing ensures proper planning well ahead of actual production and marketing.
  - (ii) Implementation of Target Costing enhances employee awareness and empowerment.
  - (iii) Foster partnership with suppliers.
  - (iv) Minimize non value-added activities.
  - (v) Encourages selection of lowest cost value added activities.
- 

**Question-33**

By appropriate presentation show the difference between 'Target Cost' and 'Traditional Costing'

 Answer



#### Question-34

Identify the companies, which seem to benefit most from target costing.

 Answer

Some companies, which seem to benefit most from target costing, are those, which maintain the following criteria:

- (i) Assembly-oriented industries, as opposed to repetitive-process industries that produce homogeneous products;
- (ii) Involved heavily with the diversification of the product lines;
- (iii) Use technologies of factory automation, including computer-aided design, flexible manufacturing systems, office automation, and computer-aided manufacturing;
- (iv) Have experienced shorter product life cycles where the pay-back for factory automation typically must be achieved in less than eight years;
- (v) Must develop systems for reducing costs during the planning, design and development stages of a product's life cycle;
- (vi) Are implementing management methods such as just-in-time, value engineering, and total quality control

**Question-35**

Identify Control Points which should be taken care of in all target costing projects.

 Answer

Control Points which should be taken care of in all target costing projects

- (i) **Identification of Principal Control Point:** Experience shows that there always comes a point, where the *cost of maintaining the design team exceeds the savings garnered from additional iterations*. It is also necessary that most products should be launched within a reasonably short time or they will miss the appropriate market, where they will beat the delivery of competing products to the market. This emphasis that the principal control points over the course of target costing programme should be properly taken care of.
- (ii) **Point of Go / No Go Decision:** If target costing is not reached, management retains power to abandon the design project. There comes a point, when actual performance is very close to expected performance in matter of cost incurrence.
- (iii) **Milestone *can be in terms of Timer or Points*:** A milestone can be in terms of time, say one month. It can also be on the points in design process, at which specific activities are completed.

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**Question-36**

Write a short note on 'Kaizen Costing'.

 Answer

Kaizen Costing is a Japanese term for a number of cost reduction steps that can be used subsequent to issuing a new product design to the factory floor. Some of the activities in the kaizen costing methodology include the elimination of waste in the production, assembly, and distribution processes, as well as the elimination of work steps in any of these areas. Though these points are also covered in the value engineering phase of target costing, the initial value engineering may not uncover all possible cost savings. Thus, kaizen costing is really designed to repeat many of the value engineering steps for as long as a product is produced, constantly refining the process and thereby stripping out extra costs. The cost reductions resulting from kaizen costing are much smaller than those achieved with value engineering but are still worth the effort since competitive pressures are likely to force down the price of a product over time, and any possible cost savings allow a company to still attain its targeted profit margins while continuing to reduce cost.

---

## Life Cycle Costing

### Question-37

*What is total-life-cycle costing approach? Why is it important?*



Life cycle costing estimates, tracks and accumulates the costs over a product's entire life cycle from its inception to abandonment or from the initial R & D stage till the final customer servicing and support of the product. It aims at tracing of costs and revenues on product by product basis over several calendar periods throughout their life cycle. Costs are incurred along the product's life cycle starting from product's design, development, manufacture, marketing, servicing and final disposal. The objective is to accumulate all the costs over a product life cycle to determine whether the profits earned during the manufacturing phase will cover the costs incurred during the pre and post manufacturing stages of product life cycle.

Product life cycle costing is important for the following reasons:

- (i) When non-production costs like costs associated with R & D, design, marketing, distribution and customer service are significant, it is essential to identify them for target pricing, value engineering and cost management. For example, a poorly designed software package may involve higher costs on marketing, distribution and after sales service.
- (ii) There may be instances where the pre-manufacturing costs like R & D and design are expected to constitute a sizeable portion of life cycle costs. When a high percentage of total life cycle costs are likely to be so incurred before the commencement of production, the firm needs an accurate prediction of costs and revenues during the manufacturing stage to decide whether the costly R & D and design activities should be undertaken.
- (iii) Many costs are locked in at R & D and design stages. Locked in or Committed costs are those costs that have not been incurred at the initial stages of R & D and design but that will be incurred in the future on the basis of the decisions that have already been taken. For example, the adoption of a certain design will determine the product's material and labour inputs to be incurred during the manufacturing stage. A complicated design may lead to greater expenditure on material and labour costs every time the product is produced. Life cycle budgeting highlights costs throughout the product life cycle and facilitates value engineering at the design stage before costs are locked in.

Total life-cycle costing approach accumulates product costs over the value chain. It is a process of managing all costs along the value chain starting from product's design, development, manufacturing, marketing, service and finally disposal.

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**Question-38**

*Explain the essential features of Life-cycle costing.*

 **Answer**

Product Life Cycle costing involves:

- (i) Tracing of costs and revenue of product over several calendar period- throughout their entire life cycle.
  - (ii) Emphasis is on Cost and revenue accumulation over the entire life cycle of the product.
  - (iii) Life cycle costing traces research and design.
  - (iv) It focuses on development costs, incurred to individual products over their entire life cycles.
  - (v) Total magnitude of research and development costs are reported and compared with product revenues generated in later periods.
- 

**Question-39**

*What is product life cycle costing? What are the costs that you would include in product life cycle cost?*

 **Answer**

Product life cycle costing traces costs and revenues of each product over several calendar periods throughout their entire life cycle. The costs are included in different stages of the product life cycle.

Development Phase – R & D Cost / Design Cost.

Introduction Phase – Promotional Cost / Capacity Costs.

Growth Phase / Maturity – Manufacturing Cost / Distribution Costs / Product Support Cost.

Decline / Replacement Phase – Plants Reused / Sold / Scrapped / Related Costs.

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**Question-40**

*Briefly explain the phases in the life cycle of a product.*



Phases in Life Cycle of a Product:

Phase	Characteristics
Introduction	Product is launched. Profits are almost non-existent. Competition is almost negligible.
Growth	Sales/ Profits rise rapidly. Competition enters.
Maturity	Sales increases but at a declining rate. Some firms extend their product lines with new models.
Saturation and Decline	Drop in sales volume, need for product demand disappears. Better and cheaper substitutes are available in the market.

## Value Chain Analysis

### Question-41

*What is the concept of 'Value-chain' and why is it important for Cost Management?*



Value chain is the linked set of value creating activities from the basic raw materials and components sources to the ultimate end use of the product or service delivered to the customer.

The six business functions contained in the value chain are (i) Research and Development, (ii) Design (iii) Production (iv) Marketing (v) Distribution and (vi) Customer service.

The objective of value chain is to serve as means of *increasing the customer satisfaction and managing costs effectively*. Coordination of the individual parts of the value chain activities creates conditions to improve customer satisfaction in terms of cost efficiency, quality and delivery. A firm which performs value chain activities more efficiently and at a lower cost than its competitors will be able to gain competitive advantage. The following methodology should be adopted.

- (i) The firm should identify the industry value chain and then assign costs, revenues and assets to value activities.
- (ii) Diagnose the cost drivers regulating each value activity.
- (iii) Develop sustainable cost advantage either by controlling cost drivers better than competitors or by reconfiguring the chain value.

By analyzing costs, revenues and assets in each activity systematically a company can achieve low cost. Thus value chain helps managers in deciding how to apply the organization's valuable physical and human resources to each linked process so as to achieve cost effectiveness.

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#### Question-42

*Define the term 'Value-Chain'. Mention three useful strategic frameworks of the Value-Chain Analysis.*

 Answer

Value chain is the linked set of value-creating activities all the way from basic raw material sources for component suppliers through to the ultimate end-use product or service delivered to the customer. Porter's described the value chain as the 'internal processes or activities a company performs to design, produce, market, deliver and support its product'. He further stated that 'a firm's value chain and the way it performs individual activities are a reflection of its history, its strategy, its approach of implementing its strategy, and the underlying economics of the activities themselves'. The business activities are classified in to primary activities and support activities.

Primary activities are those activities which are involved in transforming the inputs in to outputs, delivery and after sales service to output. Support activities are intended to support the primary activities like for example procurement, human resources management, etc.

Three useful strategic frameworks for value chain analysis are:

- (i) Industry structure analysis;
  - (ii) Core competencies; and
  - (iii) Segmentation analysis.
- 

#### Question-43

*How can value analysis achieve cost reduction?*

 Answer

Value analysis can do cost reduction in the following manner:

- (i) By identifying and removing unnecessary components in a product which had utility earlier.
  - (ii) By introducing component substitution at a lesser cost without affecting the quality of the product.
  - (iii) By simplifying the product design.
  - (iv) By introducing alternative methods with less cost but improved efficiency.
-

**Question-44**

*Classify the following business activities into primary and support activities under value chain analysis.*

- (i) *Material Handling and Warehousing.*
- (ii) *Purchasing of raw materials, supplies and other consumables.*
- (iii) *Order processing and distribution*
- (iv) *Selection, placement and promotion of employees.*

 Answer

**Classification of Business Activities into Primary and Support Activities**

Sl. No.	Business Activities	Primary/ Support
(i)	Material Handling and Warehousing	Primary Activities
(ii)	Purchasing of raw materials, supplies and other consumables	Support Activities
(iii)	Order processing and distribution	Primary Activities
(iv)	Selection, placement and promotion of employees	Support Activities

**Question-45**

*In Value Chain analysis, business activities are classified into primary activities and support activities. Classify the following under the more appropriate activity.*

- (i) *Order processing and distribution*
- (ii) *Installation, repair and parts replacement*
- (iii) *Purchase of raw material and other consumable stores*
- (iv) *Transforming inputs into final products*
- (v) *Selection, promotion, appraisal and employee relations*
- (vi) *Material handling and warehousing*
- (vii) *General management, planning, finance, accounting*
- (viii) *Communication, pricing and channel management*

 Answer

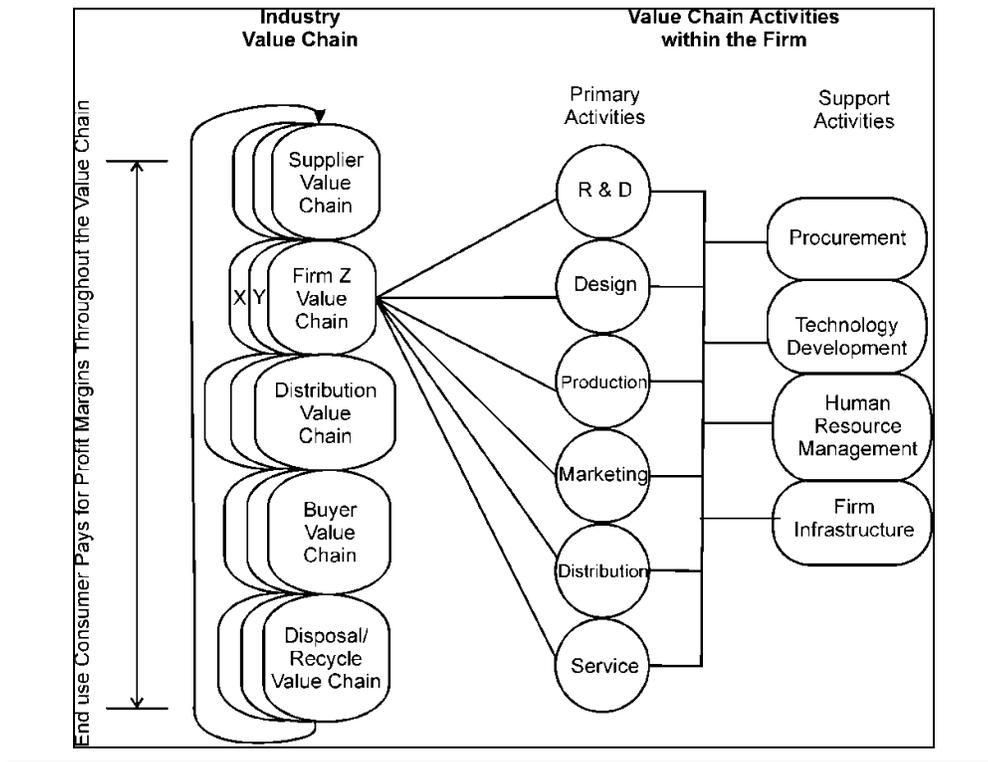
Activity	Primary Activity/Support Activity
(i) Order processing and distribution	Primary Activity
(ii) Installation, repair and parts replacement	Primary Activity

(iii)	Purchase of raw material and other consumable stores	Support Activity
(iv)	Transforming inputs into final products	Primary Activity
(v)	Selection, promotion, appraisal and employee relations	Support Activity
(vi)	Material handling and warehousing	Primary Activity
(vii)	General management, planning, finance, accounting	Support Activity
(viii)	Communication, pricing and channel management	Primary Activity

**Question-46**

Prepare a diagram showing the value chain activities within the firm with suitable classifications under primary and support activities and also the industry value chain indicating what the end use consumer pays for.

 Answer



**Question-47**

*What steps are involved in value chain analysis approach for assessing competitive advantages?*

 **Answer**

Most corporations define their mission as one of creating products and services. In contrast, the other companies are acutely aware of the strategic importance of individual activities within their value chain, They are concentrating on those activities that allow them to capture maximum value for their customers and themselves. These firms use the value chain analysis approach to better understand which segments, distribution channels, price points. Product differentiation, selling prepositions and value chain configuration will yield them the greatest competitive advantage. The way the value chain approach helps these organizations to assess competitive advantage includes the use of following steps of analysis.

- (i) Internal Cost Analysis - to determine the sources of profitability and the relative cost positions of internal value creating processes;
- (ii) Internal Differentiation Analysis - to understand the sources of differentiation with internal value-creating process; and
- (iii) Vertical Linkage Analysis - to understand the relationships and associated costs among external suppliers and customers in order to maximize the value delivered to customers and to minimize the cost.

The value chain approach used for assessing competitive advantages is an integral part of the strategic planning process. Like strategic planning, value chain analysis is a continuous process of gathering, evaluating and communicating information for business decision-making.

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**Question-48**

*"Cost can be managed only at the point of commitment and not at the point of incidence. Therefore, it is necessary to manage cost drivers to manage cost." Explain the statement with reference to structural and executional cost drivers.*

 **Answer**

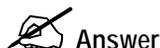
A firm commits costs at the time of designing the product and deciding the method of production. It also commits cost at the time of deciding the delivery channel (e.g. delivery through dealers or own retail stores). Costs are incurred at the time of actual production and delivery. Therefore, no significant cost reduction can be achieved at the time when the costs are incurred. Therefore, it is said that costs can be managed at the point of commitment. Cost

drivers are factors that drive consumption of resources. Therefore, management of cost drivers is essential to manage costs. Structural cost drivers are those which can be managed by effecting structural changes. Examples of structural cost drivers are scale of operation, scope of operation (i.e. degree of vertical integration), complexity, technology and experience or learning. Thus, structural cost drivers arise from the business model adopted by the company. Executional cost drivers can be managed by executive decisions, examples of executional cost drivers are capacity utilization, plant layout efficiency, product configuration and linkages with suppliers and customers. It is obvious that cost drivers can be managed only at the point of structural and operating decisions, which commit resources to various activities.

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#### Question-49

*What are the limitations of Value Chain Analysis.*



**Answer**

Limitations of Value Chain Analysis

- (i) **Non-availability of data:** Internal data on costs, revenues and assets used for value chain analysis are derived from financial information of a single period. For long term strategic decision making, changes in cost structures, market prices and capital investments etc. *may not be readily available.*
  - (ii) **Identification of stages:** Identifying stages in an industry's value chain is limited by the ability to locate at least one firm that participates in a specific stage. Breaking a value stage into two or more stages when an outside firm does not complete in these stages is strictly judgment.
  - (iii) **Ascertainment of cost, revenues and assets:** Finding the costs revenues and assets for each value chain activity poses / gives rise to serious difficulties. There is no scientific approach and much depends upon trial and error and experimentation methods.
  - (iv) **Identification of cost drivers:** Isolating cost drivers for each value-creating activity, identifying value chain linkages across activities and computing supplier and customer profit margins present serious challenges.
  - (v) **Resistance from employees:** Value chain analysis is not easily understandable to all employees and hence may face resistance from employees as well as managers.
  - (vi) **Science vs. Art:** Value chain analysis is not exact science. It is more "art" than preparing precise accounting reports. Certain judgments and factors of analysis are purely subjective and differ from person to person.
-

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### Question-50

*Differentiate between 'Traditional Management Accounting' and 'Value Chain Analysis in the strategic framework'.*

 Answer

Traditional Management Accounting focuses on internal information. It often places excessive emphasis on manufacturing costs. It also assumes that cost reduction must be found in the "Value-Added" process i.e. 'Selling Price less The Cost of Raw Material'.

The Value Chain Analysis approach encompasses external and internal data, uses appropriate cost drivers for all major value-creating processes, exploits linkages throughout the value chain, and provides continuous monitoring of a firm's strategic competitive advantages.

*Value Chain vs. Traditional Management Accounting*

Traditional Management Accounting	Value Chain Analysis in the Strategic Framework
If focuses on internal information	Focuses on external information.
Application of single cost driver at the overall firm level is taken.	Application of multiple cost drivers i.e. structural and executional are taken for each value activity.
It assume that cost reduction must be found in the value added process.	Exploits linkages throughout the value chain i.e. within firm, with suppliers and customers.
Insights for strategic decisions somewhat limited in traditional management accounting.	Identify cost driver at the individual activity level and develop cost / differentiation advantage either by controlling those drivers better than competitors by reconfiguring the value chain.

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## Cost Control Vs Cost Reduction

### Question-51

*What is difference between Cost Control & Cost Reduction.*

 Answer

Cost Reduction	Cost Control
(i) Cost Reduction is the achievement	(i) Cost Control involves a comparison

of real and permanent reduction in unit cost of products manufactured.	of actual with the standards or budgets, to regulate the actual costs.
(ii) Realistic savings in cost.	(ii) There could be temporary savings in cost.
(iii) Product's Utility, Quality and Characteristics are retained.	(iii) Quality Maintenance is not a guarantee.
(iv) It is not concerned with maintenance of performance according to standards	(iv) The process involves setting up a target, investing variances and taking remedial measures to correct them.
(v) Continuous process of critical examination includes analysis and challenge of standards.	(v) Control is achieved through compliance with standards. Standards by themselves are not examined.
(vi) Fully dynamic approach.	(vi) Less dynamic than Cost Reduction.
(vii) Universally applicable to all areas of business. Does not depend upon standards, though target amounts may be set.	(vii) Limited applicability to those items of cost for which standards can be set.
(viii) Emphasis here is partly on present costs and largely on future costs.	(viii) Emphasis on present and past behaviour of costs.
(ix) The function of Cost Reduction is to find out substitute ways and new means like waste reduction, expense reduction and increased production	(ix) Cont Control does competitive analysis of actual results with established standards.
(x) Cost reduction is a corrective measure.	(x) Cost Control is a preventive measure.

**Question-52**

*Write a note on "Application of Cost Control in Material Cost"*

 **Answer**

Materials Cost is the price paid and the cost incurred by an organization in procuring materials for production. If material cost is effectively controlled we must have a proper system of material control and the following are the fundamental requirement of such a control:-

- (i) Definite responsibility in respect of every function of material control should be specified and allocated.

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- (ii) Proper co-ordination between the various sections/departments responsible for different function should be achieved.
  - (iii) Purchasing function should be centralised as far as possible and entrusted to a competent person conversant with purchasing function.
  - (iv) Controlled procedure should be standardised and uniform forms and documents should be used all over the organisation.
  - (v) To facilitate the control procedures materials requirements budget and materials purchased budget should be prepared.
  - (vi) Adequate provision for proper storage facilities and suitable arrangements for storing materials should be made.
  - (vii) A proper system of stock control should be introduced and maintained.
- 

#### Question-53

*Name any 10 tools and techniques for 'Cost Reduction'.*

 **Answer**

Tools and techniques for cost reduction are as under-

- (i) Budgetary Control and Standard Cost
  - (ii) Value Analysis
  - (iii) Simplification and Variety Reduction
  - (iv) Economic Batch Quantity (E. B. Q.)
  - (v) Coding and Classification
  - (vi) Improvement in Design
  - (vii) Substitute Material Utilisation
  - (viii) Operational Research
  - (ix) Quality Control
  - (x) Production Planning and Control
  - (xi) Inventory Control
  - (xii) Purchase Scheduling
  - (xiii) Job evaluation and merit voting.
  - (xiv) Training and Development
  - (xv) Business Forecast
  - (xvi) Market Research
-

## Just in Time

### Question-54

*Describe the Just-in-time systems.*



A complete JIT system begins with production, includes deliveries to a company's production facilities, continues through the manufacturing plant and even includes the types of transactions processed by the accounting system.

- (i) The company must ensure that *it receives its supplies on time*, preferably directly at the production facility that needs them. The company engineers must assist suppliers at their premises and ensure defect free supplies. Thus *raw material inventory is reduced* if correct quantities are delivered as per production schedules.
  - (ii) Long *set-up times are reduced into short ones* by eliminating inefficiency. Thus the *WIP is reduced* and so is the number of products before defects are identified.
  - (iii) A 'Kanban' card, which authorizes production of the right quantity by its feeder machine ensures 'pulling' the production process and elimination of inventory. Another method is the introduction of a working cell, which is a cluster of machines run by a single trained operator. This also *identifies defects quickly and reduces maintenance costs*. Both methods are used together.
  - (iv) *Work force is trained* to be empowered to halt operations understand more about the system, product flow, different machines and thus, elaborate reporting of a past variance is eliminated.
  - (v) *Suppliers may be paid based on production units adjusted for defects.*
- 

### Question-55

*How to reduce excessive work-in-process inventory and defective parts in JIT System?*



There are two ways to reduce excessive work-in-process inventory and defective parts in JIT System.

- (i) The first involves a '**Kanban Card**' which is a notification card that a downstream machine sends to each machine that feeds it parts, authorizing the production of just enough components to fulfill the production requirements being authorized in turn by the next machine further downstream. This is also known as a "pull" system, since kanbans are initiated at the *end* of the production process, pulling work authorizations through the production system. With this approach, there is no way for work-in-process

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inventory to build up in the production system, since it can be created only with a kanban authorization.

- (ii) The second way to reduce excessive work-in-process inventory and defective parts, is to, group machines into working cells. A working cell is a small cluster of machines which can be run by a single machine operator. This individual machine operator takes each output part from machine to machine within the cell; and thus there is no way for work-in-process to build up between machines. Also, this operator can immediately identify defective output which otherwise is difficult for each machine of the cell. This configuration has the additional benefit of lower maintenance costs since the smaller machines used in a machine cell are generally much simpler than the large, automated machinery they replace. Also, because the new machines are so small, it is much easier to reconfigure the production facility when it is necessary to produce different products, avoiding the large expense of carefully repositioning and aligning equipment.

Both kanbans and machine cells should be used together—they are not mutually exclusive. By doing so a company can achieve extremely low product defect rates, as well as vanishingly small investments in work-in-process inventory.

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### Question-56

*How does the JIT approach help in improving an organisation's profitability?*



**Answer**

JIT approach helps in the reduction of costs/increase in prices as follows:

- (i) Immediate detection of defective goods being manufactured so that early correction is ensured with least scrapping.
  - (ii) Eliminates / reduces WIP between machines within working cell.
  - (iii) Overhead costs in the form of rentals for inventory, insurance, maintenance costs etc. are reduced.
  - (iv) Higher product quality ensured by the JIT approach leads to higher premium in the selling price.
  - (v) Detection of problem areas due to better production / scrap reporting / labour tracing and inventory accuracy lead to reduction in costs by improvement.
- 

### Question-57

*Explain, how the implementation of JIT approach to manufacturing can be a major source of competitive advantage.*

 **Answer**

JIT provides competitive advantage in the following ways:

- (i) Stocks of raw materials and finished goods are eliminated, stock holding costs are avoided.
  - (ii) JIT aims at elimination of non-value added activities and elimination of cost in this direction will improve competitive advantage.
  - (iii) It affords flexibility to customer requirements where the company can manufacture customized products and the competitive advantage is thereby improved.
  - (iv) It focuses the direction of performance based production of high quality product.
  - (v) It minimize waiting times and transportation costs.
- 

**Question-58**

*What do you mean by back-flushing in JIT system? What are the problems that must be corrected before it will work properly?*

 **Answer**

Backflushing requires no data entry of any kind until a finished product is completed. At that time the total amount finished is entered into the computer system, which multiplies it by all the components listed in the bill of materials for each item produced. This yields a lengthy list of components that should have been used in the production process and which is subtracted from the beginning inventory balance to arrive at the amount of inventory that should now be left of hand. Back the entire production process. Given the large transaction volumes associated with JIT, this is an ideal solution to the problem.

The following problems must be corrected before it will work properly:

- (i) Production reporting
  - (ii) Scrap reporting
  - (iii) Lot tracing
  - (iv) Inventory accuracy.
- 

## Manufacturing Resource Planning

**Question-59**

*Mention the data required to operate the material requirement planning system.*

 Answer

Data requirements to operate material requirement planning system:

- (i) **The Master Production Schedule:** This schedule specifies the quantity of each finished unit of products to be produced and the time at which each unit will be required.
- (ii) **The Bill of Material File:** The bill of material file specifies the sub-assemblies, components and materials required for each of the finished goods.
- (iii) **The Inventory File:** This file maintains details of items in hand for each sub-assembly, components and materials required for each of the finished goods.
- (iii) **The Routing File:** This file specifies the sequence of operations required to manufacture sub-assemblies, components and finished goods.
- (iv) **The Master Parts File:** This file contains information on the production time of sub-assemblies; components produced internally and lead times for externally acquired items.

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**Question-60**

*Explain the pre-requisites for successful operation of material requirement planning.*

 Answer

Pre-requisites for successful operation of material requirement planning are-

- (i) **Strict adherence to the schedule:** The successful operation of MRP system requires a strict adherence to the latest production and purchasing schedules. Workers must be educated to understand the importance of schedule adherence, and controls should be in place to ensure this adherence.
- (ii) **Accurate data base:** Data accuracy is vital to the system. If a plan is based on inaccurate data it may be impossible to adhere to the schedule. For example, if the bill of materials file is not updated to reflect any changes in product composition it will be impossible to adhere to the schedule.

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**Question-61**

Write a note on "Requirements Explosion".

 Answer

The MRP system decides the demand for materials, components and sub assemblies at each stage of production.

Once the scheduled production starts, the output of each department is pushed through the MRP system to the next department.

From the data input, the MRP system knows:

- (i) What it is expected to produce (through the MPS file)?
- (ii) How it should produce it (through the BOM file)? and with
- (iii) What it has to produce it (through the inventory records file)?

This programme starts with the finished goods demand (from the MRPs) and converts the demand requirements backward in time to schedule the desired production of the finished goods from raw materials and component parts with 'time phased' adjustments for lead time requirements. This process is called 'Requirements Explosion'.

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## Synchronous Manufacturing

### Question-62

*Brief the principles associated with synchronous manufacturing.*

 Answer

It is an all encompassing manufacturing management philosophy which includes a set of principles, procedures, and techniques where every action is evaluated in terms of common goals of the organization.

The seven principles are :

- (i) Focus on synchronizing the production flow than on idle capacities.
  - (ii) Value of time at a bottleneck resource is equal to the throughput rate of products processed by the bottle neck.
  - (iii) Value of time at a non bottleneck resource is negligible.
  - (iv) Level of utilization of a non bottleneck resource is controlled by other constraints within the system.
  - (v) Resources must be utilized, not simply activated.
  - (vi) Transfer batch should not be equal to the process batch.
  - (vii) A process batch should be variable both along its route and overtime.
-

## Throughput Accounting/ Theory of Constraints

### Question-63

*What are the focuses of Theory of Constraints ? How it differs with regard to cost behaviour?*

 Answer

The theory of constraint focuses its attention on constraints and bottlenecks within the organisation which hinder speedy production. The main concept is to maximize the rate of manufacturing output i.e. the throughput of the organisation. This requires examining the bottlenecks and constraints which are defined as:

- (i) A bottleneck is an activity within the organisation where the demand for that resource is more than its capacity to supply.
- (ii) A constraint is a situational factor which makes the achievement of objectives/throughput more difficult than it would otherwise be. Constraints may take several forms such as lack of skilled employees, lack of customer orders or the need to achieve a high level of quality product output.

Using above definition, therefore, a bottleneck is always a constraint but a constraints need not be a bottleneck.

The theory of constraints assumes few costs are variable—generally materials, purchased parts, piecework labour, and energy to run machines. It assumes that most direct labour and overheads are fixed. This is consistent with the idea that the shorter the time period, the more costs are fixed, and the idea that the theory of constraints focuses on the short run.

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### Question-64

*Classify the following items under the three measures used in the theory of constraints:*

- (i) *Research and Development Cost*
- (ii) *Rent/Utilities*
- (iii) *Raw materials used for production*
- (iv) *Depreciation*
- (v) *Labour Cost*
- (vi) *Stock of raw materials*
- (vii) *Sales*
- (viii) *Cost of equipments and buildings.*

 Answer

The 3 key measures are :

Throughput Contribution	Raw Material for Production
	Sales
Operating Costs	Rent / Utilities
	Depreciation
	Labour
Investments	Research and Development Cost
	Raw Material Stock
	Building and Equipment Cost

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## SECTION - B

### Value Added/ Non Value Added Activities

#### Problem-1

*Queenstown Furniture (QF) manufactures high-quality wooden doors within the forests of Queenstown since 1952. Management is having emphasize on creativity, engineering, innovation and experience to provide customers with the door they desire, whether it is a standard design or a one-of-a-kind custom door. The following information pertains to operations during April:*

<i>Processing time</i>	<i>9.0 hrs.*</i>	<i>Waiting time</i>	<i>6.0 hrs.*</i>
<i>Inspection time</i>	<i>1.5 hr.*</i>	<i>Move time</i>	<i>7.5 hrs.*</i>
<i>Units per batch</i>	<i>60 units</i>		

(\*) average time per batch

#### **Required**

Compute the following operational measures:

- (i) Average non-value-added time per batch
- (ii) Average value added time per batch
- (iii) Manufacturing cycle efficiency
- (iv) Manufacturing cycle time



#### **Solution**

- (i) Average Non Value Added Time *per batch*

$$\begin{aligned}
 &= \text{Inspection Time} + \text{Waiting Time} + \text{Move Time} \\
 &= 1.5 \text{ hr.} + 6.0 \text{ hrs.} + 7.5 \text{ hrs.} \\
 &= 15 \text{ hrs.}
 \end{aligned}$$
- (ii) Average Value Added Time per batch
$$\begin{aligned}
 &= \text{Processing Time} \\
 &= 9 \text{ hrs.}
 \end{aligned}$$
- (iii) Manufacturing Cycle Efficiency
$$= \frac{\text{ProcessingTime}}{\text{ProcessingTime} + \text{Inspection Time} + \text{Waiting Time} + \text{Move Time}}$$

$$= \frac{9.0 \text{ hrs.}}{9.0 \text{ hrs.} + 1.5 \text{ hr.} + 6.0 \text{ hrs.} + 7.5 \text{ hrs.}}$$

$$= 37.5\%$$

(iv) Manufacturing Cycle Time

$$= \frac{\text{Total Production Time}}{\text{Units per Batch}}$$

$$= \frac{24 \text{ hrs.}}{60 \text{ units}}$$

$$= 0.40 \text{ hrs. per unit}$$

## Total Quality Management

### Problem-2

*Hindustan Bikes Ltd. (HBL) formerly known as HELCO is an Indian multinational company. It's headquarter is located in Bengaluru, India. It has been founded in the year 1990 as a manufacturer of locomotives. The company is presently listed locally as well as in international stock market. HBL's parent company is Hindustan Group. The management of HBL recognizes the need to establish a culture at the company so that -*

*"Do the right things, right the first time, every time".*

*Management has provide you following actual information for the most recent month of the current year:*

#### Cost Data

₹

<i>Customer Support Centre Cost</i>	<i>35 per hr.</i>
<i>Equipment Testing Cost</i>	<i>18 per hr.</i>
<i>Warranty Repair Cost</i>	<i>1,560 per bike</i>
<i>Manufacturing Rework Cost</i>	<i>228 per bike</i>

#### Volume and Activity Data

<i>Bikes Requiring Manufacturing Rework</i>	<i>3,200 bikes</i>
<i>Bikes Requiring Warranty Repair</i>	<i>2,600 bikes</i>
<i>Production Line Equipment Testing Time</i>	<i>1,600 hrs.</i>
<i>Customer Support Centre Time</i>	<i>2,000 hrs.</i>

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### Additional information

HBL carried out a quality review of its existing suppliers to enhance quality levels during the month at a cost of ₹ 1,25,000. Due to the quality issues in the month, the bike production line experienced unproductive 'down time' which cost ₹ 7,70,000.

### Required

Prepare a statement showing 'Total Quality Cost'.



### Statement Showing "Total Quality Cost"

Particulars of Costs	₹
<b>Prevention Costs</b>	
Supplier Review	1,25,000
<b>Appraisal Costs</b>	
Equipment Testing (₹18 × 1,600 hrs.)	28,800
<b>Internal Failure Costs</b>	
Down Time	7,70,000
Manufacturing Rework (₹228 × 3,200 bikes)	7,29,600
<b>External Failure Costs</b>	
Customer Support (₹35 × 2,000 hrs.)	70,000
Warranty Repair (₹1,560 × 2,600 bikes)	40,56,000
<b>Total Quality Costs</b>	<b>57,79,400</b>

### Problem-3

NZ Ltd. implemented a quality improvement programme and had the following results:

Particulars	2012	2013
	(Figures in ₹'000)	
Sales	6,000	6,000
Scrap	600	300
Rework	500	400
Production Inspection	200	240
Product Warranty	300	150
Quality Training	75	150
Materials Inspection	80	60

**Required**

- (i) Classify the quality costs as prevention, appraisal, internal failure and external failure and express each class as a percentage of sales.
- (ii) Compute the amount of increase in profits due to quality improvement.

 **Solution**

(i) **Statement Showing Classification of Quality Costs"**

	2012		2013	
	₹ '000	% of Sales	₹ '000	% of Sales
Prevention:				
Quality Training	75	1.25%	150	2.50%
Appraisal:				
Product Inspection	200	3.33..%	240	4.00%
Materials Inspection	80	1.33..%	60	1.00%
Internal Failure:				
Scrap	600	10.00%	300	5.00%
Rework	500	8.33..%	400	6.66..%
External Failure:				
Product Warranty	300	5.00%	150	2.5
<b>Total</b>	<b>1,755</b>	<b>29.25%</b>	<b>1,300</b>	<b>21.66..%</b>

- (ii) Cost reduction was effected by 7.583% (29.25 – 21.66..) of sales, which is an increase in profit by ₹4,54,980.

**Problem-4**

7 Star Sports Co. (7SSC) is engaged in the manufacture of cricket bats. Following table shows the budgeted figures for the coming year:

<b>Particulars</b>	<b>₹ per unit</b>
Selling Price	4,800
Less: Components (1 Set)	1,200
Assembling Costs	2,000
Delivery Cost	800
<b>Contribution</b>	<b>800</b>

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Components like willow, rubber grip and handle bar in a set, are bought in and an assembling process carried out to transform them into a single bat. Market is intensely competitive where TSSC currently holds 30% market share. Annual demand of these bats is 1,00,000 units.

On reviewing previous performance it is revealed that 3% of the bats supplied to customers were returned for free replacement because of faults. Defective components, which are initially bought in to assembling process, are held responsible for this. These returned bats cannot be repaired and have no scrap value. Supply of faulty bats to customers could be eliminated by implementing an inspection process immediately before the goods are delivered. This would improve customer perception thus resulting in an increase of 5% in current market share (making in all a total share of 35%).

### Required

- (i) Calculate the quality non-conformance cost for the coming year, based on the budgeted figures and sales returns rate.
- (ii) Calculate the impact on profitability due to implementation of inspection process for the bats.



### Solution

#### (i) Calculation of Quality Non- Conformance Cost

Annual Sales	= 1,00,000 × 30%	
	= 30,000 units	
Number of returned bats which are replaced <i>free of cost</i>	= 30,000 units × $\frac{3}{97}$	
	= 928 units	
Cost of 928 units that are replaced <i>free of charge</i>	= 928 × ₹4,000	
	= ₹37,12,000	(A)
Contribution Lost (Market Share) due to <i>faulty bats</i>	= ₹35,04,000	(B)
So, Total Quality Non-Conformance Cost [(A) + (B)]	= ₹72,16,000	

#### Statement Showing "Contribution Lost (Market Share) due to *faulty bats*"

Particulars	₹ '000
Sales (5,000 units × ₹4,800)	24,000
Less: Variable Cost [(₹1,200 units + ₹2,000 + ₹800) × 5,000 units]	20,000
Less: Relevant Cost of <i>faulty bats</i> [155 units × (₹2,000 + ₹1,200)]	496
Contribution	3,504

$$\text{No. of Faulty Bats} = 155 \left( 5,000 \text{ units} \times \frac{3\%}{97\%} \right)$$

(ii) **Impact on Profitability due to *implementation of inspection process***

Implementing *inspection process* before delivery to the customer would eliminate risk of supplying faulty bat to the customer. This would lead to improvement in customer perception, thus increasing market share to 35%.

Additional Contribution due to *increase in market share* = ₹35,04,000 (C)

Saving in the Delivery Cost on 928 faulty bats = 928 units × ₹800  
= ₹ 7,42,400 (D)

Total Increase in Profit [(C) + (D)] = ₹ 42,46,400



**Quality Non-Conformance Costs** are costs that are incurred by a firm as an outcome of quality failures that have occurred.  
This question can be solve in *alternative ways* with logical steps and assumptions.

**Problem-5**

A company produces and sells a single product. The cost data per unit for the year 2017 is predicted as below:

	₹ per unit
Direct material	35
Direct labour	25
Variable overheads	15
Selling price	90

The company has forecast that demand for the product during the year 2017 will be 28,000 units. However to satisfy this level of demand, production quantity will be increased?

There are no opening stock and closing stock of the product.

The stock level of material remains unchanged throughout the period.

The following additional information regarding costs and revenue are given:

- 12.5% of the items delivered to customers will be rejected due to specification failure and will require free replacement. The cost of delivering the replacement item is ₹ 5 per unit.

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- 20% of the items produced will be discovered faulty at the inspection stage before they are delivered to customers.
- 10% of the direct material will be scrapped due to damage while in storage.

Due to above, total quality costs for the year is expected to be ₹ 10,75,556.

The company is now considering the following proposal:

1. To introduce training programmes for the workers which, the management of the company believes, will reduce the level of faulty production to 10%. This training programme will cost ₹ 4,50,000 per annum.
2. To avail the services of quality control consultant at an annual charges of ₹ 50,000 which would reduce the percentage of faulty items delivered to customers to 9.5%.

**Required**

- (i) Prepare a statement of expected quality costs the company would incur if it accepts the proposal. Costs are to be calculated using the four recognised quality costs heads.
- (ii) Would you recommend the proposal? Give financial and non-financial reasons.

 **Solution**

(i) **Statement Showing 'Expected Quality Costs'**

Particulars	Current Situation (₹)	Proposed Situation (₹)
Prevention Costs	---	4,50,000
Appraisal Costs	---	50,000
External Failure Costs	3,20,000	2,35,120
Internal Failure Costs	7,55,556	3,91,538
<b>Total Quality Costs</b>	<b>10,75,556</b>	<b>11,26,658</b>

**Workings**

**External Failure Cost**

Particulars	Current Situation	Proposed Situation
Customer's Demand ... (A)	28,000 units	28,000 units
Number of units Dispatched to Customers ... (B)	32,000 units	30,939 units
$\left( \frac{28,000 \text{ units}}{87.5\%} \right); \left( \frac{28,000 \text{ units}}{90.5\%} \right)$		

Number of units Replaced ... (B) – (A)	4,000 units	2,939 units
External Failure Cost {4,000 units × ₹ (35+25+15+5)}; {2,939 units × ₹ (35+25+15+5)}	₹ 3,20,000	₹ 2,35,120

**Internal Failure Cost**

Particulars	Current Situation	Proposed Situation
Number of units Dispatched to Customers ... (A)	32,000 units	30,939 units
Number of units Produced & Rejected ... (B) $\left(\frac{32,000 \text{ units}}{80\%}\right); \left(\frac{30,939 \text{ units}}{90\%}\right)$	40,000 units	34,377 units
Number of units Discovered Faulty ... (B) – (A)	8,000 units	3,438 units
Cost of Faulty Production ... (D) {8,000 units × ₹ (35+25+15)}; {3,438 units × ₹ (35+25+15)}	₹ 6,00,000	₹ 2,57,850
Material Scrapped $\left(\frac{40,000 \text{ units}}{90\%} \times 10\%\right); \left(\frac{34,377 \text{ units}}{90\%} \times 10\%\right)$	4,444.44 units	3,819.67 units
Cost of Material Scrapped ... (E) {4,444.44 units × ₹ 35}; {3,819.67 units × ₹ 35}	₹ 1,55,556	₹ 1,33,688
Internal Failure Cost ... (D)+(E)	₹ 7,55,556	₹ 3,91,538

**(ii) Recommendation**

On purely *financial grounds* the company should not accept the proposal because there is an increase of ₹ 51,102 in quality costs. However there may be *other factors* to consider as the company may enhance its reputation as a company that cares about quality products and this may increase the company's market share.

On balance the company should accept the proposal to improve its *long-term* performance.

**Problem-6**

*Thomson Ltd. makes and sells a single product; the unit specifications are as follows:*

Direct Materials X	:	8 sq. metre at ₹ 40 per square metre
Machine Time	:	0.6 Running hours

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Machine cost per gross hour : ₹ 400

Selling price : ₹ 1,000

Thomson Ltd. requires to fulfil orders for 5,000 product units per period. There are no stock of product units at the beginning or end of the period under review. The stock level of material X remains unchanged throughout the period.

Thomson Ltd. is planning to implement a Quality Management Programme (QPM). The following additional information regarding costs and revenues are given as of now and after implementation of Quality Management Programme.

Before the implementation of QMP	After the implementation of QMP
5% of incoming material from suppliers scrapped due to poor receipt and storage organisation.	Reduced to 3%.
4% of material X input to the machine process is wasted due to processing problems.	Reduced to 2.5%
Inspection and storage of Material X costs ₹ 1 per square metre purchased.	No change in the unit rate
Inspection during the production cycle, calibration checks on inspection equipment vendor rating and other checks cost ₹ 2,50,000 per period	Reduction of 40% of the existing cost.
Production Qty. is increased to allow for the downgrading of 12.5% of the production units at the final inspection stage. Down graded units are sold as seconds at a discount of 30% of the standard selling price.	Reduction to 7.5%
Production Quantity is increased to allow for return from customers (these are replaced free of charge) due to specification failure and account for 5% of units actually delivered to customer.	Reduction to 2.5%
Product liability and other claims by customers is estimated at 3% of sales revenue from standard product sale.	Reduction to 1%.
Machine idle time is 20% of Gross machine hrs used (i.e. running hour = 80% of gross/hrs.).	Reduction to 12.5%.
Sundry costs of Administration, Selling and Distribution total – ₹ 6,00,000 per period.	Reduction by 10% of the existing.
Prevention programme costs ₹ 2,00,000	Increase to ₹ 6,00,000.

The Total Quality Management Programme will have a reduction in Machine Run Time required per product unit to 0.5 hr.

**Required**

- (a) Prepare summaries showing the calculation of (i) Total production units (pre inspection), (ii) Purchase of Materials X (square metres), (iii) Gross Machine Hours.
- (b) In each case, the figures are required for the situation both before and after the implementation of the Quality Management Programme so that orders for 5,000 product units can be fulfilled.

Prepare Profit and Loss Account for Thomson Ltd. for the period showing the profit earned both before and after the implementation of the Total Quality Programme.

 **Solution**

**Working Note**

Particulars	Existing		After TQM Programme	
<b>Total Production Units (Preinspection)</b>				
Total Sales Requirements		5,000		5,000
Specification Losses	5%	<u>250</u>	2.5%	<u>125</u>
		5,250		5,125
Downgrading at Inspection	$\frac{12.5}{87.5} \times 5,250$	<u>750</u>	$\frac{7.5}{92.5} \times 5,125$	<u>416</u>
Total Units Before Inspection		6,000		5,541
<b>Purchase of Material 'X'(Sq Mtr)</b>				
Material Required to meet Pre Inspection Production Requirement (SqMtr)	$6,000 \times 8$	48,000	$5,541 \times 8$	44,328
Processing Loss	$\frac{4}{96} \times 48,000$	<u>2,000</u>	$\frac{2.5}{97.5} \times 44,328$	<u>1,137</u>
Input to the Process		50,000		45,465
Scrapped Material	$\frac{5}{95} \times 50,000$	<u>2,632</u>	$\frac{3}{97} \times 45,465$	<u>1,406</u>
Total Purchases		52,632		46,871
<b>Gross Machine Hours</b>				
Initial Requirements	$6,000 \times 0.6$	3,600	$5,541 \times 0.5$	2,771
Idle Time	$\frac{20}{80} \times 3,600$	<u>900</u>	$\frac{12.5}{87.5} \times 2,771$	<u>396</u>
Gross Time		4,500		3,167

## Profit and Loss Statement

Particulars	Existing (₹)		After TQM Programme (₹)	
	Sales Revenue	5,000 Units × ₹ 1,000	50,00,000	5,000 Units × ₹ 1,000
Sales Downgraded	750 Units × ₹ 700	<u>5,25,000</u>	416 Units × ₹ 700	<u>2,91,200</u>
		<u>55,25,000</u>		<u>52,91,200</u>
Costs:				
Material	52,632 Sq Mtr × ₹ 40	21,05,280	46,871Sq Mtr × ₹ 40	18,74,840
Inspection and Storage Costs	52,632 Sq Mtr × ₹ 1	52,632	46,871Sq Mtr × ₹ 1	46,871
Machine Cost	4,500 Hrs × ₹ 400	18,00,000	3,167 Hrs × ₹ 400	12,66,800
Inspection and Other Cost		2,50,000	₹ 2,50,000 × 60%	1,50,000
Product Liability	3% × ₹ 50,00,000	1,50,000	1% × ₹ 50,00,000	50,000
Sundry Cost of Selling, Distribution and Administration		6,00,000	₹ 6,00,000 × 90%	5,40,000
Preventive Programme Cost		<u>2,00,000</u>		<u>6,00,000</u>
		<u>51,57,912</u>		<u>45,28,511</u>
Net Profit		3,67,088		7,62,689

## Activity Based Costing

## Problem-7

Catalyst Ltd. Makes a single product with the following details:

Description	Current Situation	Proposed Change
Selling Price (₹/unit)	10	
Direct Costs (₹/unit)	5	
Present number of setups per production period, (before each production run, setup is done)	42	
Cost per set up (₹)	450	Decrease by ₹ 90
Production units per run	960	1,008
Engineering hours for production period	500	422
Cost per engineering hour (₹)	10	

The company has begun Activity Based Costing of fixed costs and has presently identified two cost drivers, viz. production runs and engineering hours. Of the total fixed costs presently at ₹ 96,000, after the above, ₹ 72,100 remains to be analyzed. There are changes as proposed above for the next production period for the same volume of output.

**Required**

- (i) How many units and in how many production runs should Catalyst Ltd. produce in the changed scenario in order to break-even?
- (ii) Should Catalyst Ltd. continue to break up the remaining fixed costs into activity based costs? Why?



**Solution**

**Workings**

**Statement Showing 'Non-unit Level Overhead Costs'**

Particulars	Current Situation	Proposed Situation
No. of Production Runs/ Setups	42	40 $\left( \frac{960 \text{ runs} \times 42 \text{ setup}}{1,008 \text{ units}} \right)$
Cost per Setup	₹ 450	₹ 360
Production Units <i>per run</i>	960 units	1,008 units
Production Units	40,320 (960 units × 42)	40,320
Engineering Hrs.	500	422
Engineering Cost <i>per hour</i>	₹ 10	₹ 10

**Requirement of Question**

- (i) Break Even Point (Changed Scenario)

Break Even Point

$$\begin{aligned}
 &= \frac{\text{Fixed Cost} + (\text{Setup Cost} \times \text{No. of Setups}) + (\text{Engineering Costs} \times \text{No. of Engineering Hrs.})}{(\text{Price} - \text{Unit Variable Cost})} \\
 &= \frac{\text{₹ } 72,100 + (\text{₹ } 360 \times 40 \text{ Setups}) + (\text{₹ } 10 \times 422 \text{ hrs.})}{(\text{₹ } 10 - \text{₹ } 5)} \\
 &= 18,144 \text{ units}
 \end{aligned}$$

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Break Even Point (No of Production Runs)

$$\begin{aligned}
 &= \frac{\text{Break Even(units)}}{\text{Production(units per run)}} \\
 &= \frac{18,144 \text{ units}}{1,008 \text{ units}} \\
 &= 18 \text{ Runs}
 \end{aligned}$$

- (ii) A company should adopt Activity Based Costing (ABC) system for *accurate product costing*, as traditional volume based costing system does not take into account the *Non-unit Level Overhead Costs* such as Setup Cost, Inspection Cost, and Material Handling Cost etc. Cost Analysis under ABC system showed that while these costs are largely fixed with respect to sales volume, but they are not fixed to other appropriate cost drivers. If break up the remaining ₹ 72,100 fixed costs consist of only a small portion of these costs, ABC need not be applied.

However, it may also be noted that the primary study has resulted in cost savings. If the savings in cost are expected to exceed the cost of study and implementing ABC, it may be justified. Further it is pertinent to mention that ABC offers no increase in product-costing accuracy for single-product setting.

### Problem-8

*Linex Limited manufactures three products P, Q and R which are similar in nature and are usually produced in production runs of 100 units. Product P and R require both machine hours and assembly hours, whereas product Q requires only machine hours. The overheads incurred by the company during the first quarter are as under:*

	₹
<i>Machine Department expenses.....</i>	<i>18,48,000</i>
<i>Assembly Department expenses.....</i>	<i>6,72,000</i>
<i>Setup costs.....</i>	<i>90,000</i>
<i>Stores receiving cost.....</i>	<i>1,20,000</i>
<i>Order processing and dispatch.....</i>	<i>1,80,000</i>
<i>Inspect and Quality control cost.....</i>	<i>36,000</i>

*The data related to the three products during the period are as under:*

	P	Q	R
<i>Units produced and sold</i>	<i>15,000</i>	<i>12,000</i>	<i>18,000</i>
<i>Machine hours worked</i>	<i>30,000 hrs.</i>	<i>48,000 hrs.</i>	<i>54,000 hrs.</i>

Assembly hours worked (direct labour hours)	15,000 hrs.	-	27,000 hrs.
Customers orders executed (in numbers)	1,250	1,000	1,500
Number of requisitions raised on the stores	40	30	50

**Required**

Prepare a statement showing details of overhead costs allocated to each product type using activity based costing.



**Calculation of "Activity Rate"**

Cost Pool	Cost (₹) [A]	Cost Driver [B]	Cost Driver Rate (₹) [C] = [A] ÷ [B]
Machine Department Expenses	18,48,000	Machine Hours (1,32,000 hrs.)	14.00
Assembly Department Expenses	6,72,000	Assembly Hours (42,000 hrs.)	16.00
Setup Cost	90,000	No. of Production Runs (450*)	200.00
Stores Receiving Cost	1,20,000	No. of Requisitions Raised on the Stores (120)	1,000.00
Order Processing and Dispatch	1,80,000	No. of Customers Orders Executed (3,750)	48.00
Inspection and Quality Control Cost	36,000	No. of Production Runs (450*)	80.00
Total (₹)	29,46,000		

\*Number of Production Run is 450 (150 + 120 + 180)

**Statement Showing "Overheads Allocation"**

Particulars of Cost	Cost Driver	P	Q	R	Total
Machine Department Expenses	Machine Hours	4,20,000 (30,000 × ₹14)	6,72,000 (48,000 × ₹14)	7,56,000 (54,000 × ₹14)	18,48,000

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Assembly Department Expenses	Assembly Hours	2,40,000 (15,000 × ₹16)	---	4,32,000 (27,000 × ₹16)	6,72,000
Setup Cost	No. of Production Runs	30,000 (150 × ₹200)	24,000 (120 × ₹200)	36,000 (180 × ₹200)	90,000
Stores Receiving Cost	No. of Requisitions Raised on the Stores	40,000 (40 × ₹1,000)	30,000 (30 × ₹1,000)	50,000 (50 × ₹1,000)	1,20,000
Order Processing and Dispatch	No. of Customers Orders Executed	60,000 (1,250 × ₹48)	48,000 (1,000 × ₹48)	72,000 (1,500 × ₹48)	1,80,000
Inspection and Quality Control Cost	No. of Production Runs	12,000 (150 × ₹80)	9,600 (120 × ₹80)	14,400 (180 × ₹80)	36,000
Overhead (₹)		8,02,000	7,83,600	13,60,400	29,46,000

### Problem-9

G-2020 Ltd. is a manufacturer of a range of goods. The cost structure of its different products is as follows:

Particulars	Product	Product	Product	
	A	B	C	
Direct Materials	50	40	40	₹/u
Direct Labour @ ₹ 10/ hour	30	40	50	₹/u
Production Overheads	30	40	50	₹/u
Total Cost	110	120	140	₹/u
Quantity Produced	10,000	20,000	30,000	Units

G-2020 Ltd. was absorbing overheads on the basis of direct labour hours. A newly appointed management accountant has suggested that the company should introduce ABC system and has identified cost drivers and cost pools as follows:

Activity Cost Pool	Cost Driver	Associated Cost
Stores Receiving	Purchase Requisitions	2,96,000
Inspection	Number of Production Runs	8,94,000
Dispatch	Orders Executed	2,10,000
Machine Setup	Number of Setups	12,00,000

The following information is also supplied:

Details	Product A	Product B	Product C
No. of Setups	360	390	450
No. of Orders Executed	180	270	300
No. of Production Runs	750	1,050	1,200
No. of Purchase Requisitions	300	450	500

### Required

Calculate activity based production cost of all the three products.



### Solution

The total production overheads are ₹26,00,000:

$$\text{Product A: } 10,000 \times ₹ 30 = ₹ 3,00,000$$

$$\text{Product B: } 20,000 \times ₹ 40 = ₹ 8,00,000$$

$$\text{Product C: } 30,000 \times ₹ 50 = ₹ 15,00,000$$

On the basis of ABC analysis this amount will be apportioned as follows:

#### Statement Showing "Activity Based Production Cost"

Activity Cost Pool	Cost Driver	Ratio	Total Amount (₹)	A (₹)	B (₹)	C (₹)
Stores Receiving	Purchase Requisition	6:9:10	2,96,000	71,040	1,06,560	1,18,400
Inspection	Production Runs	5:7:8	8,94,000	2,23,500	3,12,900	3,57,600
Dispatch	Orders Executed	6:9:10	2,10,000	50,400	75,600	84,000
Machine Setups	Setups	12:13:15	12,00,000	3,60,000	3,90,000	4,50,000
Total Activity Cost				7,04,940	8,85,060	10,10,000
Quantity Sold				10,000	20,000	30,000
Unit Cost (Overheads)				70.49	44.25	33.67
Add: Conversion Cost				80	80	90
Total				150.49	124.25	123.67

**Problem-10**

Chicago Manufacturing Co. (CMC) manufactures several product of varying levels of designs and models. It uses a single overhead recovery rate based on direct labour hours. The overheads incurred by the CMC in the half of the year are as under:

	₹
Machine operation expenses.....	10,12,500
Machine maintenance expenses.....	1,87,500
Salaries of technical staff.....	6,37,500
Wages and salaries of stores staff.....	2,62,500

During this period, CMC introduced activity based costing system and the following significant activities were identified:

- receiving materials and components
- set up of machines for production runs
- quality inspection

It is determined that:

- The machine operation and machine maintenance expenses should be apportioned between stores and production activity in 20:80 ratio.
- The technical staff salaries should be apportioned between machine maintenance , set up and quality inspection in 30:40:30 ratio.

The consumption of activities during the period under review are as under:

- Direct labour hours worked 40,000
- Direct wage rate ₹ 6 per hour
- Production set-ups 2,040
- Material and component consignments from received from suppliers 1,960
- Number of quality inspections carried out 1,280

The data relating to two product manufactured by the CMC during the period are as under:

	Product P	Product Q
Direct material costs (₹)	6,000	4,000
Direct labour hours	960	100
Direct material consignments received	48	52
Production runs	36	24
Number of quality inspections done	30	10
Quantity produced (units)	15,000	5,000

A potential customer has approached CMC for the supply of 24,000 units of a component K to be delivered in lots of 3,000 units per quarter. The job will involve an initial design cost of ₹60,000 and the manufacture will involve the following per quarter:

Direct material costs	₹ 12,000
Direct labour hours	300
Production runs	6
Inspections	24
Number of consignments of Direct materials to be received	20

CMC desires a mark up of 25% on cost.

**Required**

- (i) Calculate the cost of product P and Q based on the existing system of single overhead recovery rate.
- (ii) Determine the cost of product P and Q using activity based costing system.
- (iii) Compute the sales value per quarter of component K using activity based costing system.

**Solution**

(i)

**Statement Showing "Computation of Cost of Product P and Q"**  
(Based on the Existing System of 'Single Overhead Recovery Rate')

	Product P	Product Q
Units	15,000	5,000
Direct Materials Cost (₹)	6,000	4,000
Direct Labour Cost (₹)	5,760 (960 hours x ₹6)	600 (100 hours x ₹6)
Overheads (₹) (Refer to W.N. 1)	50,400 (960 hours x ₹ 52.50)	5,250 (100 hours x ₹52.50)
Total Cost of Products (₹)	62,160	9,850
Cost per unit (₹)	4.144 (₹ 62,160 / 15,000 units)	1.97 (₹ 9,850 / 5,000 units)

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(ii)

Statement Showing Computation of Cost of Products P and Q  
(Using 'Activity Based Costing System')

	Product P	Product Q
Units	15,000	5,000
Direct Materials Cost (₹)	6,000	4,000
Direct Labour Cost (₹)	5,760	600
Receiving Cost (Refer to W.N. 4)	13,243 (48 x ₹275.89)	14,346 (52 x ₹275.89)
Setup Cost (Refer to W.N. 4)	24,141 (36 x ₹670.59)	16,094 (24 x 670.59)
Inspection Cost (Refer to W.N. 4)	4,482 (30 x ₹149.41)	1,494 (10 x ₹149.41)
Total Cost of Products (₹)	53,626	36,534
Cost per unit (₹)	3.58 (₹53,626 / 15,000 units)	7.31 (₹36,534 / 5,000 units)

(iii)

Computation of Sales Value per Quarter 'Component K'  
(Using 'Activity Based Costing System')

3,000 units of 'Component K' to be delivered <i>per quarter</i>	₹
Initial Design Cost <i>per quarter</i> (₹60,000 / 8 quarters)	7,500
Direct Material Cost	12,000
Direct Labour Cost (300 hours x ₹6)	1,800
Receiving Cost (20 No. of Consignment x ₹275.89)	5,518
Setup Cost (6 Production Runs x ₹670.59)	4,024
Inspection Cost (24 Inspections x ₹149.41)	3,586
Total Cost	34,428
Add: Mark up (25% of cost)	8,607
Sales Value	43,035
Selling Price <i>per unit</i> 'K' (₹43,035 / 3,000 units)	14.35

**Working Notes**

**1. Overhead Rate per Labour Hour**

$$= \frac{\text{Total Overhead Incurred by the Company in First Half Year}}{\text{Total Direct Labour Hours Worked}}$$

$$= \frac{₹21,00,000}{40,000 \text{ hours}}$$

$$= ₹ 52.50 \text{ per labour hour}$$

**2. Statement Showing Apportionment of 'Technical Staff Salaries' Over 'Machine Maintenance', 'Setup' and 'Quality Inspection' in the Ratio 30:40:30**

	Total Salaries (₹)	Machine Maintenance (₹)	Setup (₹)	Quality Inspection (₹)
Technical Staff Salaries	6,37,500	1,91,250	2,55,000	1,91,250

**3. Statement Showing Apportionment of 'Machine Operation' and 'Machine Maintenance' Between 'Stores' and 'Production Activity (Setup)'**

	Total Expenses (₹)	Stores / Receiving (₹)	Setup (₹)
Machine Operation (20:80)	10,12,500	2,02,500	8,10,000
Machine Maintenance (20:80) [₹1,91,250 + ₹1,87,500] (Refer to W.N. 2)	3,78,750	75,750	3,03,000
Wages and Salaries of Stores Staff	2,62,500	2,62,500	----
Component of Setup Cost (Refer to W.N. 2)	2,55,000	----	2,55,000
<b>Total</b>	<b>19,08,750</b>	<b>5,40,750</b>	<b>13,68,000</b>

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### 4. Rate per 'Activity Cost Driver'

	Stores / Receiving (₹)	Setup (₹)	Quality Inspection (₹)
Total Overheads (₹) ... (A)	5,40,750	13,68,000	1,91,250
Units of Activities Carried out ... (B)	1,960	2,040	1,280
Rate per Activity Cost Driver (₹) ...{(A) / (B)}	275.89	670.59	149.41

#### Problem-11

During the last 20 years, JPY Ltd's manufacturing operation has become increasingly automated with Computer-controlled robots replacing operators. JPY currently manufactures over 100 products of varying levels of design complexity. A single plant wise overhead absorption rate, based on direct labour hours, is used to absorb overhead costs.

In the quarter ended March, JPY's manufacturing overhead costs were:

	(₹'000)
Equipment Operation Expenses.....	125
Equipment Maintenance Expense.....	25
Wages Paid to Technicians.....	85
Wages Paid to Store Men.....	35
Wages Paid to Despatch Staff.....	40

During the quarter, the company reviewed the Cost Accounting System and concluded that absorbing overhead costs to individual products on a labour hour absorption basis is meaningless. Overhead costs should be attributed to products using an Activity Based Costing (ABC) system and the following was identified as the most significant activities:

- (i) Receiving component consignments from suppliers
- (ii) Setting up equipment for production runs
- (iii) Quality inspections
- (iv) Despatching goods as per customer's orders.

During the quarter:

- (i) a total of 2,000 direct labour hours were worked (paid at ₹ 12 per hr.)
- (ii) 980 components consignments were received from suppliers

- (iii) 1020 production runs were set up
- (iv) 640 quality inspections were carried out
- (v) 420 orders were dispatched to customers.

Equipment operation and maintenance expenses are apportioned as:

- Component stores 15% , manufacturing 70% and goods dispatch 15% Technician's wages are apportioned as:
- Equipment maintenance 30% , set up equipment for production runs 40% and quality inspections 30%

JPY's production during the quarter included components R, S and T. The following information is available:

	Component R	Component S	Component T
Direct Material	₹ 1,200	₹ 2,900	₹ 1,800
Direct Labour Hrs worked	25	480	50
Component Consignments Recd.	42	24	28
Production Runs	16	18	12
Quality Inspections	10	8	18
Orders (goods) Despatched	22	85	46
Quantity Produced	560	12,800	2,400

**Required**

- (i) Calculate the unit cost of R, S and T components, using JPY's existing cost accounting system.
- (ii) Explain how an ABC system would be developed using the information given. Calculate the unit cost of components R, S and T using ABC system.

 **Solution**

(i) Single Factory Direct Labour Hour Overhead Rate =  $\frac{₹ 3,10,000}{2,000}$   
 = ₹ 155 per Direct Labour Hour

## Computation of Unit Cost (Existing System)

	R (₹)	S (₹)	T (₹)
Direct Labour Cost @ ₹ 12 per Hour	300	5,760	600
Direct Material	1,200	2,900	1,800
Overheads (Direct Labour Hours × ₹ 155 per Hour)	3,875	74,400	7,750
Total Cost	5,375	83,060	10,150
Quantity Produced (No.s)	560	12,800	2,400
Cost per unit	9.60	6.49	4.23

(ii) ABC system involves the following stages,

- Identifying the major activities that take place in an organisation.
- Creating a cost pool /cost centre for each activity.
- Determining the cost driver for each activity.
- Assigning the cost of activities to cost objects (e.g. products, components, customers etc).

The most significant activities have been identified e.g. receiving components consignments from suppliers, setting up equipment for production runs, quality inspections, and despatching orders to customers. The following shows the assignment of the costs to these activities.

(₹, 000)

Particulars	Receiving Supplies	Setups	Quality Inspection	Despatch	Total
Equipment Operation Expenses	18.75	87.50	----	18.75	125.00
Maintenance	3.75	17.50	----	3.75	25.00
Technicians Wages [Initially allocated to Maintenance(30% of ₹ 85,000) and then reallocated on same basis on Maintenance]	3.83	17.85	----	3.82	25.50
Balance of Technicians Wages (Allocated to Setups and Quality Inspections)	----	34.00	25.50	----	59.50

Stores Wages - Receiving	35.00	----	----	----	35.00
Despatch Wages - Despatch	----	----	----	40.00	40.00
Total	61.33	156.85	25.50	66.32	310.00

Equipment operation expenses and Maintenance allocated on the basis 15%,70% and 15% as specified in the problem.

The next stage is to identify the cost drivers for each activity and establish cost driver rates by dividing the activity costs by a measure of cost driver usage for the period. The calculations are as follows:-

$$\text{Receiving Supplies} \left[ \frac{\text{₹}61,330}{980\text{Consignments}} \right] = \text{₹ } 62.58 \text{ per Consignment}$$

$$\text{Performing Setups} \left[ \frac{\text{₹}1,56,850}{1,020\text{ProductionRuns}} \right] = \text{₹ } 153.77 \text{ per Setup}$$

$$\text{Despatching Goods} \left[ \frac{\text{₹}66,320}{420\text{Orders}} \right] = \text{₹ } 157.90 \text{ per Despatch}$$

$$\text{Quality Inspection} \left[ \frac{\text{₹}25,500}{640\text{Inspections}} \right] = \text{₹ } 39.84 \text{ per Quality Inspection}$$

Finally, costs are assigned to components based on their cost driver usage. The assignments are as follows:

Particulars of Costs	R (₹)	S (₹)	T (₹)
Direct Labour	300.00	5,760.00	600.00
Direct Materials	1,200.00	2,900.00	1,800.00
Receiving Supplies	2,628.36	1,501.92	1,752.24
Performing Setups	2,460.32	2,767.86	1,845.24
Quality Inspections	398.40	318.72	717.12
Despatching Goods	3,473.80	13,421.50	7,263.40
Total Costs	10,460.88	26,670.00	13,978.00
No of Units Produced	560	12,800	2,400
Cost per unit	18.68	2.08	5.82

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For components, the overhead costs have been assigned as follows:

Particulars	Component R	Component S	Component T
Receiving Supplies	₹ 2,628.36 (42 Receipts at ₹ 62.58)	₹ 1,501.92 (24 Receipts at ₹ 62.58)	₹1,752.24 (28 Receipts at ₹ 62.58)
Performing Setups	₹2,460.32 (16 Production Runs at ₹ 153.77)	₹2,767.86 (18 Production Runs at ₹ 153.77)	₹1,845.24 (12 Production Runs at ₹ 153.77)
Quality Inspections	₹398.40 (10 Inspections at ₹ 39.84)	₹318.72 (8 Inspections at ₹ 39.84)	₹717.12 (18 Inspections at ₹ 39.84)
Despatching Goods	₹3,473.80 (22 Orders at ₹ 157.90)	₹13,421.50 (85 Orders at ₹ 157.90)	₹7,263.40 (46 Orders at ₹ 157.90)

### Problem-12

Super Food Ltd. Manufactures 3 types of biscuits, A, B and C, in a fully mechanised factory. The company has been following conventional method of costing and wishes to shift to Activity Based Costing System and therefore wishes to have the following data presented under both the systems for the month.

Inspection Cost	₹ p.m.	73,000
Machine – Repairs & Maintenance	₹ p.m.	1,42,000
Dye Cost	₹ p.m.	10,250
Selling Overheads	₹ p.m.	1,62,000

	Product A	Product B	Product C
Prime Cost (₹ per unit)	12	9	8
Selling Price (₹ per unit)	18	14	12
Gross Production (units / production run)	2,520	2,810	3,010
No. of Defective (units / production run)	20	10	10

	Product A	Product B	Product C
Inspection:	3	4	4
No. of Hours / Production Run			
Dye Cost / Production Run (₹)	200	300	250
No. of Machine Hours / Production Run	20	12	30
Sales – No. of Units / Month	25,000	56,000	27,000

The following additional information is given:

- (i) No accumulation of inventory is considered. All good units produced are sold.
- (ii) All manufacturing and selling overheads are conventionally allocated on the basis of units sold.
- (iii) Product A needs no advertisement. Due to its nutritive value, it is readily consumed by diabetic patients of a hospital. Advertisement costs included in the total selling overhead is ₹ 83,000.
- (iv) Product B needs to be specially packed before being sold, so that it meets competition. ₹ 54,000 was the amount spent for the month in specially packing B, and this has been included in the total selling overhead cost given.

**Required**

Present product wise profitability of statements under the conventional system and the ABC system and accordingly rank the products.

 Solution

**Statement Showing “Gross Margin”**

Particulars	A	B	C	Total
Sales Units	25,000	56,000	27,000	1,08,000
Selling Price per unit	18	14	12	
Sales Value (₹) ... (A)	4,50,000	7,84,000	3,24,000	15,58,000
Prime Cost Overhead	12	9	8	
No. of Units per run	2,520	2,810	3,010	
Prime Cost (₹) ... (B)	3,02,400	5,05,800	2,16,720	
Gross Margin ... (A) - (B)	1,47,600	2,78,200	1,07,280	5,33,080

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Statement Showing "Production & Selling Overheads"

Particulars	A	B	C	Total
Inspection Cost $\left(\frac{73,000}{146} \times 30 / 80 / 36 \text{ respectively}\right)$	15,000	40,000	18,000	73,000
Machine Maintenance $\left(\frac{1,42,000}{710} \times 200 / 240 / 270 \text{ respectively}\right)$	40,000	48,000	54,000	1,42,000
Dye Cost	2,000	6,000	2,250	10,250
Production Overheads	57,000	94,000	74,250	2,25,250
Advertisement $\left(\frac{83,000}{56,000 + 27,000} \times 56 / 27 \text{ respectively}\right)$	----	56,000	27,000	83,000
Packing	----	54,000	----	54,000
Other Overheads $\left(\frac{25,000}{108} \times 25 / 56 / 27 \text{ respectively}\right)$	5,787	12,963	6,250	25,000
Selling Overheads	5,787	1,22,963	33,250	1,62,000

Workings

No.	Particulars	A	B	C	Total
(1)	Gross Production (unit /run)	2,520	2,810	3,010	
(2)	Defectives / Run	20	10	10	
(3)	Good Units / Run	2,500	2,800	3,000	
(4)	Sales (goods units)	25,000	56,000	27,000	
(5)	No. of Runs	10	20	9	
(6)	Gross Production ... $(1 \times 5)$	25,200	56,200	27,090	
(7)	Prime Cost / Unit	12	9	8	
(8)	Prime Cost (₹)	3,02,400	5,05,800	2,16,720	10,24,920
(9)	Inspection Hours / Run	3	4	4	
(10)	Inspection Hours ... $(9 \times 5)$	30	80	36	146

(11)	M/c Hours / Run	20	12	30	
(12)	M/c Hours ... (11 × 5)	200	240	270	710
(13)	Dye Cost / Run	200	300	250	
(14)	Dye Cost ... (13 × 5)	2,000	6,000	2,250	10,250

**“Statement Showing Rank - Conventional Accounting System”**

Particulars	A	B	C	Total
Sales – Units / Production (good units)	25,000	56,000	27,000	1,08,000
Gross Margin (₹) ... (A)	1,47,600	2,78,200	1,07,280	5,33,080
Production Overheads (₹)	52,141	1,16,797	56,313	2,25,250
Selling Overheads (₹)	37,500	84,000	40,500	1,62,000
Sub-Total Overheads (₹) ... (B)	89,641	2,00,797	96,813	3,87,250
Net Profit (₹) ... (A) – (B)	57,959	77,403	10,467	1,45,830
Ranking	II	I	III	

**Statement Showing “Rank - Activity Based System”**

Particulars	A	B	C	Total
Sales – Units / Production (good units)	25,000	56,000	27,000	1,08,000
Gross Margin (₹) ... (A)	1,47,600	2,78,200	1,07,280	5,33,080
Production Overheads (₹)	57,000	94,000	74,250	2,25,250
Selling Overheads (₹)	5,787	1,22,963	33,250	1,62,000
Sub-Total Overheads (₹) ... (B)	62,787	2,16,963	1,07,500	3,87,250
Net Profit (₹) ... (A) – (B)	84,813	61,237	(220)	1,45,830
Ranking	I	II	III	

**Problem-13**

*‘Humara - Apna’ bank offers three products, viz., deposits, Loans and Credit Cards. The bank has selected 4 activities for a detailed budgeting exercise, following activity based costing methods.*

*The bank wants to know the product wise total cost per unit for the selected activities, so that prices may be fixed accordingly.*

*The following information is made available to formulate the budget:*

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Activity	Present Cost (₹)	Estimation for the budget period
ATM Services:		
(a) Machine Maintenance	4,00,000	All fixed, no change.
(b) Rents	2,00,000	Fully fixed, no change.
(c) Currency Replenishment Cost	1,00,000	Expected to double during budget period.
	7,00,000	(This activity is driven by no. of ATM transactions)
Computer Processing	5,00,000	Half this amount is fixed and no change is expected. The variable portion is expected to increase to three times the current level. (This activity is driven by the number of computer transactions)
Issuing Statements	18,00,000	Presently, 3 lac statements are made. In the budget period, 5 lac statements are expected. For every increase of one lac statement, one lac rupees is the budgeted increase. (This activity is driven by the number of statements)
Computer Inquiries	2,00,000	Estimated to increase by 80% during the budget period. (This activity is driven by telephone minutes)

The activity drivers and their budgeted quantities are given below:

Activity Drivers	Deposits	Loans	Credit Cards
No. of ATM Transactions	1,50,000	---	50,000
No. of Computer Processing Transactions	15,00,000	2,00,000	3,00,000
No. of Statements to be issued	3,50,000	50,000	1,00,000
Telephone Minutes	3,60,000	1,80,000	1,80,000

The bank budgets a volume of 58,600 deposit accounts, 13,000 loan accounts, and 14,000 Credit Card Accounts.

**Required**

- (i) Calculate the budgeted rate for each activity.
- (ii) Prepare the budgeted cost statement activity wise.
- (iii) Find the budgeted product cost per account for each product using (i) and (ii) above.

 **Solution**

**Statement Showing "Budgeted Cost *per unit* of the Product"**

Activity	Activity Cost (Budgeted) (₹)	Activity Driver	No. of Units of Activity Driver (Budget)	Activity Rate (₹)	Deposits	Loans	Credit Cards
ATM Services	8,00,000	No. of ATM Transaction	2,00,000	4.00	6,00,000	---	2,00,000
Computer Processing	10,00,000	No. of Computer Transaction	20,00,000	0.50	7,50,000	1,00,000	1,50,000
Issuing Statements	20,00,000	No. of Statements	5,00,000	4.00	14,00,000	2,00,000	4,00,000
Customer Inquiries	3,60,000	Telephone Minutes	7,20,000	0.50	1,80,000	90,000	90,000
Budgeted Cost	41,60,000				29,30,000	3,90,000	8,40,000
Units of Product (as estimated in the budget period)					58,600	13,000	14,000
Budgeted Cost <i>per unit</i> of the product					50	30	60

**Working Note**

Activity	Budgeted Cost (₹)	Remark
ATM Services:		
(a) Machine Maintenance	4,00,000	- All fixed, no change.
(b) Rents	2,00,000	- Fully fixed, no change.
(c) Currency Replenishment Cost	2,00,000	- Doubled during budget period.
Total	8,00,000	

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Activity	Budgeted Cost (₹)	Remark
Computer Processing	2,50,000	- ₹2,50,000 (half of ₹5,00,000) is fixed and no change is expected. - ₹2,50,000 (variable portion) is expected to increase to three times the current level.
	7,50,000	
Total	10,00,000	
Issuing Statements	18,00,000	- Existing. - 2 lac statements are expected to be increased in budgeted period. For every increase of one lac statement, one lac rupees is the budgeted increase.
	2,00,000	
Total	20,00,000	
Computer Inquiries	3,60,000	- Estimated to increase by 80% during the budget period. (₹2,00,000 x 180%)
Total	3,60,000	

Problem-14

Bank of HK operated for years under the assumption that profitability can be increased by increasing Rupee volumes. But that has not been the case. Cost analysis has revealed the following:

Activity	Activity Cost (₹)	Activity Driver	Activity Capacity
Providing ATM Service	1,00,000	No. of Transactions	2,00,000
Computer Processing	10,00,000	No. of Transactions	25,00,000
Issuing Statements	8,00,000	No. of Statements	5,00,000
Customer Inquiries	3,60,000	Telephone Minutes	6,00,000

The following annual information on three products was also made available:

Activity Driver	Checking Accounts	Personal Loans	Gold Visa
Units of Product	30,000	5,000	10,000
ATM Transactions	1,80,000	0	20,000

Computer Transactions	20,00,000	2,00,000	3,00,000
Number of Statements	3,00,000	50,000	1,50,000
Telephone Minutes	3,50,000	90,000	1,60,000

**Required**

- (i) Calculate rates for each activity.  
 (ii) Using the rates computed in requirement (i), calculate the cost of each product.

 **Solution**
**Statement Showing "Activity Rate"**

Activity	Activity Cost [a] (₹)	Activity Driver	No. of Units of Activity Driver [b]	Activity Rate [a] / [b] (₹)
Providing ATM Service	1,00,000	No. of ATM Transactions	2,00,000	0.50
Computer Processing	10,00,000	No. of Computer Transactions	25,00,000	0.40
Issuing Statements	8,00,000	No. of Statements	5,00,000	1.60
Customer Inquiries	3,60,000	Telephone Minutes	6,00,000	0.60

**Statement Showing "Cost of Product"**

Activity	Checking Accounts (₹)	Personal Loans (₹)	Gold Visa (₹)
Providing ATM Service	90,000 (1,80,000 tr. × ₹ 0.50)	---	10,000 (20,000 tr. × ₹ 0.50)
Computer Processing	8,00,000 (20,00,000 tr. × ₹ 0.40)	80,000 (2,00,000 tr. × ₹ 0.40)	1,20,000 (3,00,000 tr. × ₹ 0.40)
Issuing Statements	4,80,000 (3,00,000 st. × ₹ 1.60)	80,000 (50,000 st. × ₹ 1.60)	2,40,000 (1,50,000 st. × ₹ 1.60)
Customer Inquiries	2,10,000 (3,50,000 min. × ₹ 0.60)	54,000 (90,000 min. × ₹ 0.60)	96,000 (1,60,000 min. × ₹ 0.60)
Total Cost [a]	₹ 15,80,000	₹ 2,14,000	₹ 4,66,000
Units of Product [b]	30,000	5,000	10,000
Cost of each Product [a] / [b]	52.67	42.80	46.60

## Problem-15

DEO Limited sells two versions: Deluxe and Premium of its only product GoGo Juicer. The GoGo Juicer uses patented technology to extract the last drop of juice from most fruits. The 'Premium' version can handle larger fruit and has more options relative to the 'Deluxe' version. The following table provides the financial results of the most recent year of operations:

Particulars	Deluxe 90,000 units	Premium 10,000 units	Total 1,00,000 units
Revenue (₹)	63,00,000	9,00,000	72,00,000
Material cost (₹)	10,80,000	2,50,000	13,30,000
Direct labour cost (₹)	14,40,000	1,60,000	16,00,000
Contribution margin (₹)	37,80,000	4,90,000	42,70,000
Allocated fixed manufacturing overhead (₹)	34,20,000	3,80,000	38,00,000
Allocated fixed selling and administrative overheads (₹)	2,51,563	35,937	2,87,500
Profit margin (₹)	1,08,437	74,063	1,82,500
Profit margin per unit (₹)	1.2048	7.4063	

Labour cost is ₹ 16 per hour and each product requires one hour of labour. The company currently allocates all fixed manufacturing overheads, using labour hours as the allocation basis. It allocates fixed selling and administrative overheads, using revenue as the allocation base.

Although the profit margin per unit of 'Deluxe' juicer is rather low, DEO Limited believes that it is important to keep this model in the product mix. However, DEO can tailor its promotion and sales strategies to improve the sales mix to 16:4 ratio from the current 9:1 ratio of 'Deluxe' to 'Premium' juicers, with total volume staying at 1,00,000 units.

DEO Limited finds that ₹ 1.1 million of the ₹ 3.8 million of fixed manufacturing overheads pertains to batch related activities such as scheduling production runs. Similarly, ₹ 1,15,000 is the amount of administrative overheads out of the ₹ 2,87,500 of selling and administrative overheads.

It is found that the 'premium' juicer is produced in smaller batches (250 units per batch) than that of 'Deluxe' juicer (500 units per batch). Similarly, it takes 10 sales visits to sell 1,000 units of the 'Deluxe' juicer, while it takes 25 visits to sell 1,000 units of 'Premium' juicer.

**Required**

- (i) Prepare a profitability statement based on the proposed sales mix, using the most appropriate basis of allocating fixed overheads. (In absence of an appropriate basis, do not allocate overheads to products)
- (ii) Advise the company on whether it should go ahead with the proposed change in sales mix.

 **Solution**

(i) **Profitability Statement New Mix - Most Appropriate Basis**

Particulars	Deluxe		Premium		Total (₹)
	80,000 Units		20,000 Units		
	P.U.	Amount	P.U.	Amount	
	(₹)	(₹)	(₹)	(₹)	
Revenue	70.00	56,00,000.00	90.00	18,00,000.00	74,00,000.00
Material Cost	12.00	9,60,000.00	25.00	5,00,000.00	14,60,000.00
Direct Labour Cost [One hour per unit; (80,000 hrs., 20,000 hrs.)]	16.00	12,80,000.00	16.00	3,20,000.00	16,00,000.00
Contribution Margin	42.00	33,60,000.00	49.00	9,80,000.00	43,40,000.00
Unit Related Fixed Mfg. Overheads [Allocation on the basis of direct labour hours (80,000:20,000); (W.N.1)]		21,60,000.00		5,40,000.00	27,00,000.00
Batch Related Fixed Mfg. Overheads [Allocation on the basis of no. of batches (160:80); (W.N. 1 & 4)]		7,33,333.33		3,66,666.67	11,00,000.00
Fixed Selling Overheads [Allocated on the basis of sales visits (800:500); (W.N. 2 & 3)]		1,06,153.85		66,346.15	1,72,500.00
Profit Margin Ex Admin Overheads		3,60,512.82		6,987.18	3,67,500.00
Admin Overheads [W.N. 2]					1,15,000.00
Profit Margin					2,52,500.00

## Working Note

## W.N.1

Fixed Mfg. Overheads	38,00,000.00
Less: Related to <i>batch related activities</i>	11,00,000.00
Fixed Mfg. Overheads – <i>unit related</i>	27,00,000.00

## W.N.2

Selling & Admn. Overheads	2,87,500.00
Less: Admn. Overheads	1,15,000.00
Selling Overheads	1,72,500.00

## W.N.3

No. of Visits	10 Sales Visit for 1,000 Units (Deluxe)	25 Sales Visit for 1,000 Units (Premium)	Total
For Proposed Mix - Sales Visit	800	500	1,300

## W.N.4

No. of Batches	1 Batch for 500 Units (Deluxe)	1 Batch for 250 Units (Premium)	Total
For Proposed Mix - Batches	160	80	240

- (ii) Change in product mix, yields profit of ₹ 70,000/- (₹ 2,52,500 - ₹ 1,82,500). Accordingly company should go with proposed change mix.



This problem can be solved by assuming that some portion of the fixed cost as fixed with respect to units of production, but variable with respect to certain activities. When the production size is altered, these activities are increased and therefore, the activity cost varies for the proposed production level. More batches of production and more sales visits will set off the incremental contribution.

**Problem-16**

Asian Mfg. Co. had decided to increase the size of the store. It wants the information about the probability of the individual product lines : Lemon, Grapes and Papaya. It provides the following data for the 2013 for each product line:

<b>Particulars</b>	<b>Lemon</b>	<b>Grapes</b>	<b>Papaya</b>
Revenues (₹)	79,350	2,10,060	1,20,990
Cost of goods sold (₹)	60,000	1,50,000	90,000
Cost of bottles returned (₹)	1,200	0	0
Number of purchase orders placed	36	84	36
Number of deliveries received	30	219	66
Hours of shelf stocking time	54	540	270
Items sold	12,600	1,10,400	30,600

Asian Mfg. Co. also provides the following information for the year 2013:

<b>Activity</b>	<b>Description of Activity</b>	<b>Total Costs (₹)</b>	<b>Cost Allocation Basis</b>
Bottle returns	Returning of empty bottles to the store	1,200	Direct tracing to product line
Ordering	Placing of orders of purchases	15,600	156 purchase orders
Delivery	Physical delivery and the receipts of merchandise	25,200	315 deliveries
Self stocking	Stocking of merchandise on store shelves and ongoing restocking	17,280	864 hours of time
Customer support	Assistance provided to customers including bagging and checkout	30,720	1,53,600 items sold

**Required**

- (i) Asian Mfg. Co. currently allocates store support costs (all costs other than the cost of goods sold) to the product line on the basis of the cost of goods sold of each product line. Calculate the operating income and operating income as the percentage of revenue of each product line.

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- (ii) If Asian Mfg. Co. allocates store support costs (all costs other than the cost of goods sold) to the product lines on the basis of ABC system, calculate the operating income and operating income as the percentage of revenue of each product line.
- (iii) Compare both the systems.

 Solution

- (i) Traditional Costing System

Operating Income-

Particulars	Lemon	Grapes	Papaya	Total
Revenue	79,350	2,10,060	1,20,990	4,10,400
Less: Cost of Goods Sold	60,000	1,50,000	90,000	3,00,000
Less: Store Support Cost	18,000	45,000	27,000	90,000
Operating Income	1,350	15,060	3,990	20,400
Operating Income (%)	1.70	7.17	3.30	4.97

- (ii) ABC System

Overhead Allocation Rate-

Activity	Total Costs (₹)	Quantity of Cost Allocation Base	Overhead Allocation Rate (₹)
Ordering	15,600	156 Purchase Orders	100.00
Delivery	25,200	315 Delivering Orders	80.00
Shelf Stocking	17,280	864 Self Stocking Hours	20.00
Customer Support	30,720	1,53,600 Items Sold	0.20

Store Support Cost-

Particulars	Cost Driver	Lemon	Grapes	Papaya	Total
Bottle Returns	Direct	1,200	0	0	1,200
Ordering	Purchase Orders	3,600	8,400	3,600	15,600
Delivery	Deliveries	2,400	17,520	5,280	25,200
Self Stocking	Hours of time	1,080	10,800	5,400	17,280
Customer Support	Items Sold	2,520	22,080	6,120	30,720
Grand Total		10,800	58,800	20,400	90,000

**Operating Income-**

Particulars	Lemon	Grapes	Papaya	Total
Revenue	79,350	2,10,060	1,20,990	410,400
Less: Cost of Goods Sold	60,000	1,50,000	90,000	300,000
Less: Store Support Cost	10,800	58,800	20,400	90,000
Operating Income	8,550	1,260	10,590	20,400
Operating Income (%)	10.78	0.60	8.75	4.97

**(iii) Comparison**

Particulars	Lemon	Grapes	Papaya	Total
Under Traditional Costing System	1.70%	7.17%	3.30%	4.97%
Under ABC System	10.78%	0.60%	8.75%	4.97%

The grapes line drops sizeably when ABC is used. Although it constitutes 50 % of 'Cost of Goods Sold (COGS)', it uses a higher percentage of total resources in each activity area, especially the high cost of customer support area. In contrast, lemon line draws a much lower percentage of total resources used in each activity area than its percentage of total COGS. Hence under ABC, Lemon is most profitable. Fruitolay can explore ways to increase sales of lemons and also explore price increases on grapes.

Operating Income Ranking is highest for Grapes under Traditional System because other products bear its overhead cost, whereas under ABC a more accurate picture shows Grapes as the lowest ranking product.

**Problem-17**

*Golden North Ltd. manufactures four products, namely A, B, C and D using the same plant and process. The following information relates to a production period:*

	Product A	Product B	Product C	Product D
Output in units	720	600	480	504
Cost per unit:	₹	₹	₹	₹
Direct Material	42	45	40	48
Direct Labour	10	9	7	8
Machine hours per unit	4 hrs.	3 hrs.	2 hrs.	1 hr.

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The four products are similar and are usually produced in production runs of 24 units and sold in batches of 12 units. Using machine hour rate currently absorbs the production overheads. The total overheads incurred by the company for the period is as follows:

Machine operation and maintenance cost (₹)	63,000
Setup costs (₹)	20,000
Store receiving (₹)	15,000
Inspection (₹)	10,000
Material handling and dispatch (₹)	2,592

During the period the following cost drivers are to be used for the overhead cost:

Activity	Cost Driver
Setup cost	No. of production runs
Store receiving	Requisition raised
Inspection	No. of production runs
Material handling and dispatch	Orders executed

It is also determined that:

- Machine operation and maintenance cost should be apportioned between setup cost, store receiving and inspection activity in 4:3:2.
- Number of requisition raised on store is 50 for each product and the no. of order executed is 192, each order being for a batch of 12 of a product.

### Required

- Calculate the total cost of each product, if all overhead costs are absorbed on machine hour rate basis.
- Calculate the total cost of each product using activity base costing.
- Comment briefly on differences disclosed between overhead traced by present system and those traced by activity based costing.

 Solution

(i) Overhead Absorption on Machine Hour Basis

Statement Showing "Total Cost of Products"

Particulars	A (₹)	B (₹)	C (₹)	D (₹)
Direct Material	42	45	40	48
Direct Labour	10	09	07	08
Overheads	72	54	36	18
Cost of Production <i>per unit</i>	124	108	83	74
Output in units	720	600	480	504
Total Cost	89,280	64,800	39,840	37,296

[6,144 Machine Hours (720 units × 4 hrs. + 600 units × 3 hrs. + 480 units × 2 hrs. + 504 units × 1 hrs.)]

$$\text{Rate per hour} = \frac{\text{₹ } 1,10,592}{6,144 \text{ hours}} = \text{₹ } 18 \text{ per hour}$$

(ii) Activity Based Costing System

Statement Showing "Allocation of Machine Operation and Maintenance Cost"

Particulars	Setup	Receiving	Inspection
Machine Operation and Maintenance Cost of ₹ 63,000 to be distributed in the ratio of 4: 3: 2	28,000	21,000	14,000

Statement Showing "Activities/ Drivers/ Cost"

Activity	Cost (₹)	Drivers	Nos	Cost <i>per unit</i> of Driver (₹)
Setup	48,000	Production Runs	96	500.00
Store Receiving	36,000	Requisitions Raised	200	180.00
Inspection	24,000	Production Runs	96	250.00
Material Handling and Disp.	2,592	Orders	192	13.50

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Note:

Production Run for A (720/24)	=	30
B (600/24)	=	25
C (480/24)	=	20
D (504/24)	=	21

Statement Showing "Total Cost of Products"

Particulars of Costs	A (₹)	B (₹)	C (₹)	D (₹)
Direct Material	30,240	27,000	19,200	24,192
Direct Labour	7,200	5,400	3,360	4,032
Setup	15,000 $\left[ \frac{720\text{units}}{24\text{units}} \times ₹500 \right]$	12,500 $\left[ \frac{600\text{units}}{24\text{units}} \times ₹500 \right]$	10,000 $\left[ \frac{480\text{units}}{24\text{units}} \times ₹500 \right]$	10,500 $\left[ \frac{504\text{units}}{24\text{units}} \times ₹500 \right]$
Store Receiving	9,000 $[50\text{Req.} \times ₹180]$	9,000 $[50\text{Req.} \times ₹180]$	9,000 $[50\text{Req.} \times ₹180]$	9,000 $[50\text{Req.} \times ₹180]$
Inspection	7,500 $\left[ \frac{720\text{units}}{24\text{units}} \times ₹250 \right]$	6,250 $\left[ \frac{600\text{units}}{24\text{units}} \times ₹250 \right]$	5,000 $\left[ \frac{480\text{units}}{24\text{units}} \times ₹250 \right]$	5,250 $\left[ \frac{504\text{units}}{24\text{units}} \times ₹250 \right]$
Material Handling and Dispatch	810 $\left[ \frac{720\text{units}}{12\text{units}} \times ₹13.5 \right]$	675 $\left[ \frac{600\text{units}}{12\text{units}} \times ₹13.5 \right]$	540 $\left[ \frac{480\text{units}}{12\text{units}} \times ₹13.5 \right]$	567 $\left[ \frac{504\text{units}}{12\text{units}} \times ₹13.5 \right]$
Total Cost	69,750	60,825	47,100	53,541
Cost per unit	96.875	101.375	98.125	106.23

(iii)

Particulars	A (₹)	B (₹)	C (₹)	D (₹)
Cost per unit (Traditional) ... (a)	124.00	108.00	83.00	74.00
Cost per unit (ABC) ... (b)	96.88	101.38	98.13	106.23
Difference ... (b) – (a)	(27.12)	(6.62)	15.13	32.23

The total overheads which are spread over the four products have been apportioned on different bases, causing the product cost to differ substantially: in respect of product A and D a change from traditional machine hour rate to an activity system may have effect on price and profits to the extent that pricing is based on cost plus approach.

**Problem-18**

*Woolmark Ltd. manufactures three types of products namely P, Q and R. The data relating to a period are as under:*

<b>Particulars</b>	<b>P</b>	<b>Q</b>	<b>R</b>
<i>Machine hours per unit</i>	10	18	14
<i>Direct Labour hours per unit @ ₹ 20</i>	4	12	8
<i>Direct Material per unit (₹)</i>	90	80	120
<i>Production (units)</i>	3,000	5,000	20,000

*Currently the company uses traditional costing method and absorbs all production overheads on the basis of machine hours. The machine hour rate of overheads is ₹ 6 per hour.*

*The company proposes to use activity based costing system and the activity analysis is as under:*

<b>Particulars</b>	<b>P</b>	<b>Q</b>	<b>R</b>
<i>Batch size (units)</i>	150	500	1,000
<i>Number of purchase orders per batch</i>	3	10	8
<i>Number of inspections per batch</i>	5	4	3

*The total production overheads are analysed as under:*

<i>Machine set up costs.....</i>	20%
<i>Machine operation costs.....</i>	30%
<i>Inspection costs.....</i>	40%
<i>Material procurement related costs.....</i>	10%

**Required**

- (i) Calculate the cost per unit of each product using traditional method of absorbing all production overheads on the basis of machine hours.
- (ii) Calculate the cost per unit of each product using activity based costing principles.

 Solution

## (i) Statement Showing "Cost per unit - Traditional Method"

Particulars of Costs	P (₹)	Q (₹)	R (₹)
Direct Materials	90	80	120
Direct Labour [(4, 12, 8 hours) × ₹20]	80	240	160
Production Overheads [(10, 18, 14 hours) × ₹6]	60	108	84
Cost per unit	230	428	364

## (ii) Statement Showing "Cost per unit - Activity Based Costing"

Products	P	Q	R
Production (units)	3,000	5,000	20,000
	(₹)	(₹)	(₹)
Direct Materials (90, 80, 120)	2,70,000	4,00,000	24,00,000
Direct Labour (80, 240, 160)	2,40,000	12,00,000	32,00,000
Machine Related Costs @ ₹1.80 per hour (30,000, 90,000, 2,80,000)	54,000	1,62,000	5,04,000
Setup Costs @ ₹9,600 per setup (20, 10, 20)	1,92,000	96,000	1,92,000
Inspection Costs @ ₹4,800 per inspection (100, 40, 60)	4,80,000	1,92,000	2,88,000
Purchase Related Costs @ ₹750 per purchase (60, 100, 160)	45,000	75,000	1,20,000
Total Costs	12,81,000	21,25,000	67,04,000
Cost per unit (Total Cost ÷ Units)	427.00	425.00	335.20

**Workings**

**Number of Batches, Purchase Orders, and Inspections-**

	Particulars	P	Q	R	Total
A.	Production (units)	3,000	5,000	20,000	
B.	Batch Size (units)	150	500	1,000	
C.	Number of Batches [A ÷ B]	20	10	20	50
D.	Number of Purchase Order <i>per batch</i>	3	10	8	
E.	Total Purchase Orders [C × D]	60	100	160	320
F.	Number of Inspections <i>per batch</i>	5	4	3	
G.	Total Inspections [C × F]	100	40	60	200

**Total Machine Hours-**

	Particulars	P	Q	R
A.	Machine Hours <i>per unit</i>	10	18	14
B.	Production (units)	3,000	5,000	20,000
C.	Total Machine Hours [A × B]	30,000	90,000	2,80,000

Total Machine Hours = 4,00,000

**Total Production Overheads-**

= 4,00,000 hrs. × ₹ 6

= ₹ 24,00,000

**Cost Driver Rates-**

Cost Pool	%	Overheads (₹)	Cost Driver (Units)	Cost Driver Rate (₹)
Setup	20%	4,80,000	50	9,600 per Setup
Inspection	40%	9,60,000	200	4,800 per Inspection
Purchases	10%	2,40,000	320	750 per Purchase
Machine Hours	30%	7,20,000	4,00,000	1.80 per Machine Hour

## Problem-19

The following are Product Alpha's data for next year budget:

Activity	Cost Driver	Cost Driver Volume / Year	Cost Pool (₹)
Purchasing	Purchase orders	1,500	75,000
Setting	Batches produced	2,800	1,12,000
Materials handling	Materials movements	8,000	96,000
Inspection	Batches produced	2,800	70,000
Machining costs	Machine hours	50,000	1,50,000

Purchase orders.....	25
Output.....	15,000 units
Production batch size.....	100 units
Materials movements per batch.....	6
Machine hours per unit.....	0.1

**Required**

- Calculate the budgeted overhead costs using activity based costing principles.
- Calculate the budgeted overhead costs using absorption costing (absorb overhead using machine hours).
- How can the company reduce the ABC for Product Alpha?

**Solution**

- 'Budgeted Overhead Costs' using 'Activity Based Costing'

## Computation of 'Cost per unit of Cost Driver'

Activity	Cost Driver	Cost Pool [(a)]	Cost Driver Volume / Yr [(b)]	Cost / Unit of Cost Driver [(a) / (b)]
Purchasing	Purchase Orders	₹ 75,000	1,500	₹ 50 per Purchase Order
Setting	Batches Produced	₹ 112,000	2,800	₹ 40 per Batch
Materials Handling	Material Movements	₹ 96,000	8,000	₹ 12 per Movement
Inspection	Batches Produced	₹ 70,000	2,800	₹ 25 per Batch
Machining	Machine Hours	₹ 150,000	50,000	₹ 3 per Machine Hour

Computation of the 'Volume of Cost Drivers' consumed by 'Product Alpha'

Purchase Orders (given)	= 25
Batches (15,000 / 100)	= 150
Materials Movement (150 batches × 6)	= 900
Machine Hours (15,000 units × 0.1)	= 1,500

Computation of the 'Overheads Cost' for 'Product Alpha'

Activity	Cost Driver	Costing Rate / Cost Driver Unit (₹)	Overhead Cost (₹)
Purchasing	Purchase Orders	50	₹1,250 (25 Order × ₹50)
Setting	Batches Produced	40	₹6,000 (150 Batches × ₹ 40)
Material Handling	Material Movements	12	₹10,800 (900 Movement × ₹12)
Inspection	Batches Produced	25	₹ 3,750 (150 Batches × ₹ 25)
Machining	Machine Hours	3	₹ 4,500 (1,500 Hours × ₹ 3)
<b>Total</b>			<b>₹ 26,300</b>

(ii) 'Budgeted Overheads Costs' using 'Absorption Costing'

Budgeted Overheads	= ₹ 503,000
(₹ 75,000 + ₹ 96,000 + ₹ 112,000 + ₹ 70,000 + ₹ 150,000)	
Budgeted Absorption Cost per Machine Hour	= ₹10.06
(₹503,000 / 50,000 Hours)	
Budgeted Machining Hours for Product Alpha	= 1,500 hrs.
Budgeted Absorbed Overhead (1,500 hrs. × ₹ 10.06)	= ₹15,090

(iii) Ways in which the company can reduce the ABC for 'Product Alpha'

- Reduce the number of batches by increasing the batch size which will then reduce the setting up overhead, materials handling and inspection costs.
- Reduce the number of purchase orders.
- Innovate ways of speeding up production so that the machining hours are reduced.

## Target Costing

### Problem-20

UK Ltd. prepared a draft budget for the next year as follows:

Quantity – 10,000 units

	₹
Selling Price per unit	60
Variable Cost per unit	
Direct Materials	16
Direct Labour (2 hrs × ₹6)	12
Variable Overheads (2 hrs × ₹1)	2
Contribution per unit	30
Total Budgeted Contribution	3,00,000
Total Budgeted Fixed Overheads	2,80,000
Total Budgeted Profit	20,000

The board of directors are not satisfied with this draft budget and suggested the following changes for the better profit:

- (i) The budgeted profit is ₹ 50,000,
- (ii) The company should spend ₹ 57,000 on advertisement and the target sales price up to 64 per unit.
- (iii) It is expected that the sales volume will also rise, inspite of the price rise, to 12,000 units.

In order to achieve the extra production capacity, however, the work force must be able to reduce the time taken to make each unit of the product. It is proposed to offer a pay and productivity deal in which the wages rate per hour is increased to ₹ 8. The hourly rate for variable overheads will be unaffected.

### Required

Calculate the target labour time require to achieve the target profit.

 Solution

Statement Showing 'Target Cost of Direct Labour & Variable Overheads'

Particulars	Amount (₹)
Expected Sales (₹ 64 × 12,000 units)	7,68,000
Less: Direct Material (₹ 16 × 12,000 units)	1,92,000
Advertisement Expenses	57,000
Fixed Overheads	2,80,000
Target Profit	50,000
Target Cost of Direct Labour and Variable Overheads	1,89,000

Target Labour Time Required to achieve Target Profit

$$\begin{aligned}
 &= \frac{\text{Target Cost of Direct Labour and Variable Overheads}}{\text{WagesRate} + \text{Variable OverheadRate}} \\
 &= \frac{\text{₹ 1,89,000}}{\text{₹ 8} + \text{₹ 1}} \\
 &= 21,000 \text{ hrs.}
 \end{aligned}$$

Problem-21

NEC Ltd. manufactures two parts 'P' and 'Q' for Computer Industry.

P : Annual production and sales of 1,00,000 units at a selling price of ₹100.05 per unit.

Q : Annual production and sales of 50,000 units at a selling price of ₹150 per unit.

Direct and Indirect costs incurred on these two parts are as follows:

(₹ in thousand)

Particulars of Costs	P	Q	Total
Direct Material Cost (Variable)	4,200	3,000	7,200
Labour Cost (Variable)	1,500	1,000	2,500
Direct Machining Cost (See Note)*	700	550	1,250
<b>Indirect Costs</b>			
Machine Setup Cost			462
Testing Cost			2,375
Engineering Cost			2,250

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*Note: Direct machining costs represents the cost of machine capacity dedicated to the production of each product. These costs are fixed and are not expected to vary over the long-run horizon.*

*Additional information is as follows:*

	<b>P</b>	<b>Q</b>
<i>Production Batch Size</i>	1,000 units	500 units
<i>Set-up Time per batch</i>	30 hours	36 hours
<i>Testing Time per unit</i>	5 hours	9 hours
<i>Engineering Cost incurred on each product</i>	8.40 lakhs	14.10 lakhs

*A foreign competitor has introduced product very similar to 'P'. To maintain the company's share and profit, NEC Ltd. has to reduce the price to ₹ 86.25. The company calls for a meeting and comes up with a proposal to change design of product 'P'. The expected effect of new design is as follows:*

- *Direct Material cost is expected to decrease by ₹ 5 per unit.*
- *Labour cost is expected to decrease by ₹ 2 per unit.*
- *Machine time is expected to decrease by 15 minutes, previously it took 3 hours to produce 1 unit of 'P'. The machine will be dedicated to the production of new design.*
- *Set up time will be 28 hours for each set up.*
- *Time required for testing each unit will be reduced by 1 hour.*
- *Engineering cost and batch size will be unchanged.*

### **Required**

- (i) *Company management identifies that cost driver for Machine set-up costs is 'Set up hours used in batch setting' and for testing costs is 'testing time'. Engineering costs are assigned to products by special study. Calculate the full cost per unit for 'P' and 'Q' using Activity-Based Costing.*
- (ii) *What is the Mark-up on full cost per unit of P?*
- (iii) *What is the Target Cost per unit for new design to maintain the same markup percentage on full cost per unit as it had earlier? Assume cost per unit of cost drives for the new design remains unchanged.*
- (iv) *Will the new design achieve the cost reduction target?*

- (v) List four possible management actions that the NEC Ltd. should take regarding new design.

 Solution

**Working Notes**

Particulars		P	Q
(a)	Production / Sales Quantity (units)	1,00,000	50,000
(b)	Batch Size (units)	1,000	500
(c)	No. of Batches <span style="float: right;">...(a ÷ b)</span>	100	100
(d)	Setup Time per Batch (hours)	30	36
(e)	Total Setup Hours (hours) <span style="float: right;">...(c × d)</span>	3,000	3,600
(f)	Machine Setup Cost ₹ 4,62,000		
(g)	Cost Driver per Machine Setup Hour = $\frac{₹4,62,000}{6,600\text{hours}} = ₹70$		
(h)	Testing Time per Unit (hours)	5	9
(i)	Total Testing Time (hours) <span style="float: right;">...(a × h)</span>	5,00,000	4,50,000
(j)	Testing Cost ₹23,75,000		
(k)	Cost Driver per Testing Hour = $\frac{₹23,75,000}{9,50,000\text{hours}} = ₹2.50$		

- (i) Statement Showing "Cost *per unit*- Activity Based Costing"

Particulars of Costs	Basis	P	Q
Direct Material	Direct	42,00,000	30,00,000
Direct Labour	Direct	15,00,000	10,00,000
Direct Machine Cost	Direct	7,00,000	5,50,000
Machine Setup Cost	3,000 hrs. @ ₹70	2,10,000	----
	3,600 hrs. @ ₹70	----	2,52,000
Testing Cost	5,00,000 hrs. @ ₹2.50	12,50,000	----
	4,50,000 hrs. @ ₹2.50	----	11,25,000

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Engineering Cost	Allocated	8,40,000	14,10,000
Total Cost (₹)		87,00,000	73,37,000
Cost per unit (₹)		87.00	146.74

(ii) Statement Showing "Mark-up (*full cost basis*)- Product P"

Particulars	Per unit
Selling Price	100.05
Less: Full Cost	87.00
Markup	13.05
Percentage of Markup on Full Cost $\left[ \frac{13.05}{87.00} \times 100 \right]$	15%

(iii) Statement Showing "Target Cost of Product P"  
(After New Design is Implemented)

Particulars	(₹)
Target Price (given)	86.25
Mark-up $\left[ \frac{86.25}{115.00} \times 15 \right]$	11.25
Target Cost per unit	75.00

(iv) Statement Showing "Cost of P (New Design)"

Particulars of Costs	Basis of Costs	Rate*	Total Cost
Direct Material	Decrease by ₹ 5 p.u.	37.00	37,00,000
Direct Labour	Decrease by ₹ 2 p.u.	13.00	13,00,000
Direct Machining Cost	No Change as Machine is Dedicated	7.00	7,00,000
Machine Setup Cost	100 Setup × 28 hrs. × ₹ 70	1.96	1,96,000
Testing Cost	1,00,000 units × ₹ 2.50 × 4 hrs.	10.00	10,00,000
Engineering Cost	No Change	8.40	8,40,000
Total Cost		77.36	77,36,000

\*Rate per unit

The target cost is ₹ 75 p.u. and estimated cost (new design) is ₹ 77.36 p.u. The new design does not achieve the target cost set by NEC Ltd. Hence the target mark up shall not be achieved.

(v) Possible Management Action

- Value engineering and value analysis to reduce the direct material costs.
- Time and motion study in order to redefine the direct labour time and related costs.
- Exploring possibility of cost reduction in direct machining cost by using appropriate techniques.
- Identification of non-value added activities and eliminating them in order to reduce overheads.
- The expected selling price based on estimated cost of ₹ 77.36 per unit is (₹ 77.36 +15%) ₹ 88.96. Introduce sensitivity analysis after implementation of new design to study the sales quantity changes in the price range of ₹ 86.25 to ₹ 88.96.

**Problem-22**

*Ice-Cream Ltd. is engaged in production of three types of ice-cream products: Coco, Strawberry and Vanilla. The company presently sells 50,000 units of Coco @ ₹ 25 per unit, Strawberry 20,000 @ ₹ 20 per unit and Vanilla 60,000 units @ ₹ 15 per unit. The demand is sensitive to selling price and it has been observed that every reduction of ₹ 1 per unit in selling price, increases the demand for each product by 10% to the previous level. The company has the production capacity of 60,500 units of Coco, 24,200 units of Strawberry and 72,600 units of Vanilla. The company marks up 25% on cost of the product.*

*The Company management decides to apply ABC analysis. For this purpose it identifies four activities and the rates as follows:*

<u>Activity</u>	<u>Cost Rate</u>
Ordering.....	₹ 800 per purchase order
Delivery.....	₹ 700 per delivery
Shelf stocking.....	₹ 199 per hour
Customer support and assistance.....	₹ 1.10 p.u. sold

*The other relevant information for the products are as follows:*

<b>Particulars</b>	<b>Coco</b>	<b>Strawberry</b>	<b>Vanilla</b>
<i>Direct Material p.u. (₹)</i>	8	6	5
<i>Direct Labour p.u. (₹)</i>	5	4	3

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No. of Purchase Orders	35	30	15
No. of Deliveries	112	66	48
Shelf Stocking Hours	130	150	160

Under the traditional costing system, store support costs are charged @ 30% of prime cost. In ABC these costs are coming under customer support and assistance.

**Required**

- (i) Calculate target cost for each product after a reduction of selling price required to achieve the sales equal to the production capacity.
- (ii) Calculate the total cost and unit cost of each product at the maximum level using traditional costing.
- (iii) Calculate the total cost and unit cost of each product at the maximum level using activity based costing.
- (iv) Compare the cost of each product calculated in (i) and (ii) with (iii) and comment on it.

 **Solution**

- (i) Cost of Products Under 'Target Costing'

Statement Showing "Demedanded Unit and Selling Price"

Coco		Strawberry		Vanilla	
Selling Price	Demand	Selling Price	Demand	Selling Price	Demand
25	50,000	20	20,000	15	60,000
24	55,000	19	22,000	14	66,000
23	60,500	18	24,200	13	72,600

Statement Showing "Cost per unit"

Particulars	Coco	Strawberry	Vanilla
Selling Price after reduction	23.00	18.00	13.00
Profit Mark up 25% on Cost (20 % on Selling Price)	4.60	3.60	2.60
Target Cost of Production (per unit)	18.40	14.40	10.40

(ii) Cost of Product Under 'Traditional Costing'

**Statement Showing "Cost per unit"**

Particulars	Coco (₹)	Strawberry (₹)	Vanilla (₹)
Units	60,500	24,200	72,600
Material Cost per unit	8.00	6.00	5.00
Labour Cost per unit	5.00	4.00	3.00
Prime Cost per unit	13.00	10.00	8.00
Store Support Costs (30% of Prime)	3.90	3.00	2.40
Cost per unit	16.90	13.00	10.40

(iii) Cost of Product Under 'Activity Based Costing'

**Statement Showing "Cost per unit"**

Particulars	Coco (₹)	Strawberry (₹)	Vanilla (₹)
Units	60,500	24,200	72,600
Material Cost	4,84,000	1,45,200	3,63,000
Labour Cost	3,02,500	96,800	2,17,800
Prime Cost	7,86,500	2,42,000	5,80,800
Ordering Cost @ ₹ 800 (35, 30, 15)	28,000	24,000	12,000
Delivery Cost @ ₹ 700 (112, 66, 48)	78,400	46,200	33,600
Shelf Stocking @ ₹ 199 (130,150,160)	25,870	29,850	31,840
Customer Support ₹ 1.10	66,550	26,620	79,860
Total Cost	9,85,320	3,68,670	7,38,100
Cost Per unit	16.29	15.23	10.17

(iv) Comparative Analysis of 'Cost of Production'

Particulars	Coco (₹)	Strawberry (₹)	Vanilla (₹)
(a) As per Target Costing	18.40	14.40	10.40
(b) As per Traditional Costing	16.90	13.00	10.40

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(c) As per Activity Based Costing	16.29	15.23	10.17
(a) – (c)	2.11	(-) 0.83	0.23
(b) – (c)	0.61	(-) 2.23	0.23

**Comment**

The cost of product of strawberry is higher in ABC method in comparison to target costing and traditional methods. It indicated that actual profit under ABC is less than targeted. For remaining two products, ABC is most suitable.

**Problem-23**

*Transnet Ltd. is engaged in the production of four products: A, B, C and D. The price charged for the four products are ₹ 180, ₹ 175, ₹ 130 and ₹ 180 respectively, Market research has indicated that if Transnet Ltd can reduce the selling prices of its products by ₹ 5, it will be successful in getting bulk orders and gain a significant share of market of those products. The company's profit markup is 25 per cent on cost of the product. The relevant information of products are as follows:*

<b>Products</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
Output in units	600	500	400	600
Cost per unit -				
Direct material (in ₹)	40	50	30	60
Direct labour (in ₹)	28	21	14	21
Machine hours (per unit)	4	3	2	3

*The four products are usually produced in production runs of 20 units and sold in batches of 10 units. The production overhead is currently absorbed by using a machine hour rate, and the total of the production overheads for the period has been analysed as follows:*

	(₹)
Machine department costs.....	52,130
Setup costs.....	26,250
Stores receiving.....	18,000
Inspection / Quality control.....	10,500
Material handling and dispatch.....	23,100

The cost drivers to be used for the overhead costs are as follows:

Cost..... Cost drivers  
 Setup costs..... Number of production runs  
 Store receiving..... Requisitions raised  
 Inspection / Quality control..... Number of production runs  
 Materials handling and dispatch..... Order executed

The number of requisitions raised in the stores was 100 for each product and the number of orders executed was 210, each order being for a batch of 10 units of a product.

**Required**

- (i) To compute the target cost for each product.
- (ii) To compute total cost of each product using activity based costing.
- (iii) Compare target cost and activity based cost of each product and comment whether the price reduction is profitable or not.



**Solution**

(i) Statement Showing "Target Cost of Product A, B, C, D"

Product	Present Price (₹)	Proposed Price (₹)	Target Cost (₹) (with 25% Margin)
A	180	175	140
B	175	170	136
C	130	125	100
D	180	175	140

(ii) Statement Showing "Cost/unit of Driver- ABC"

Cost	Amount	Driver	No.	Cost / unit of Driver (₹)
Setups	26,250	Production Runs	105	250.00
Stores Receiving	18,000	Requisition	400	45.00
Inspection / Quality	10,500	Production Runs	105	100.00
Handling / Dispatch	23,100	Orders	210	110.00
Machine Department	52,130	Machine Hrs.	6,500	8.02

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Production Runs = 105

$$\left[ \frac{600\text{units}}{20\text{units}} + \frac{500\text{units}}{20\text{units}} + \frac{400\text{units}}{20\text{units}} + \frac{600\text{units}}{20\text{units}} \right]$$

No. of Requisitions = 400

[100 for each product]

Machine Hours = 6,500 hours

[600 units x 4 hrs. + 500 units x 3 hrs. + 400 units x 2 hrs. + 600 units x 3 hrs.]

No. of Orders = 210

$$\left[ \frac{600\text{units}}{10\text{units}} + \frac{500\text{units}}{10\text{units}} + \frac{400\text{units}}{10\text{units}} + \frac{600\text{units}}{10\text{units}} \right]$$

Statement Showing "Total Cost & Cost *per unit*- ABC"

Particulars of Costs	A (₹)	B (₹)	C (₹)	D (₹)
Direct Material	24,000	25,000	12,000	36,000
Direct Labour	16,800	10,500	5,600	12,600
Setup	7,500 [30Runsx₹250]	6,250 [25Runsx₹250]	5,000 [20Runsx₹250]	7,500 [30Runsx₹250]
Stores Receiving	4,500 [100Req.x₹45]	4,500 [100Req.x₹45]	4,500 [100Req.x₹45]	4,500 [100Req.x₹45]
Inspection / Quality	3,000 [30Runsx₹100]	2,500 [25Runsx₹100]	2,000 [20Runsx₹100]	3,000 [30Runsx₹100]
Handling / Dispatch	6,600 [60Ordersx₹110]	5,500 [50Ordersx₹110]	4,400 [40Ordersx₹110]	6,600 [60Ordersx₹110]
Machine Dept. Cost	19,248 [2,400hrs.x₹8.02]	12,030 [1,500hrs.x₹8.02]	6,416 [800hrs.x₹8.02]	14,436 [1,800hrs.x₹8.02]
Total Cost	81,648	66,280	39,916	84,636
Output (Units)	600	500	400	600
Cost <i>per unit</i>	136.08	132.56	99.79	141.06

(iii) Statement Showing "Target Cost Vs Actual Cost"

Cost	A (₹)	B (₹)	C (₹)	D (₹)
Actual	136.08	132.56	99.79	141.06
Target	140.00	136.00	100.00	140.00
Difference	(-) 3.92	(-) 3.44	(-) 0.21	(+) 1.06

**Comment**

The total actual cost of A, B and C product is less than the target cost so there is no problem in reducing the cost of these product by ₹ 5 from the present price. It will increase the profitability of the company but the cost of D is slightly more than the target cost, it is therefore, suggested that the company should either control it or redesign it.

**Problem-24**

*Speedo Limited is a specialist car manufacturer that produces various models of cars. The organization is due to celebrate its 100<sup>th</sup> anniversary next year. To mark the occasion, Speedo Limited intends to produce a sports car; the Model Royal. As this will be a special edition, production will be limited to 1,000 numbers of Model Royal Cars.*

*Speedo Limited is considering using a target costing approach and has conducted market research to determine the features that consumers require in a sports car. Based on this market research and knowledge of competitor's products, company has decided to price the Model Royal at ₹ 9.75 Lacs. Company requires an operating profit margin of 25% of the selling price of the car. Details for the forthcoming year are as follows:*

*Forecast of direct costs for a Model Royal Car-*

Labour	₹ 2,50,000
Material	₹ 4,75,000

*Forecast of annual overhead costs-*

	₹ in Lacs	Cost Driver
Production Line Cost	2,310	See Note 1
Transportation Costs	900	See Note 2

**Note 1**

The production line that would be used for Model Royal has a capacity of 60,000 machine hours per year. The production line time required for Model Royal is 6 machine hours per car. This production line will also be used to make other cars and will be working at full capacity.

**Note 2**

Some models of cars are delivered to showrooms using car transporters. 60% of the transportation costs are related to the number of deliveries made. 40% of the transportation costs are related to the distance travelled.

The car transporters have forecast to make a total of 640 deliveries in the year and carry 10 cars each time. The car transporter will always carry its maximum capacity of 10 cars.

The total annual distance travelled by car transporters is expected to be 2,25,000 kms. 50,000 kms of this is for the delivery of Model Royals car only. All 1,000 Model Royal cars that will be produced will be delivered in the year using the car transporters.

**Required**

- (i) Calculate the forecast total cost of producing and delivering a Model Royal car using Activity Based Costing principles to assign the overhead costs.
- (ii) Calculate the cost gap that currently exists between the forecast total cost and the target total cost of a Model Royal car.

**Solution****Workings**

Statement Showing "Cost Driver Rate"

Overhead	Cost (₹) - Lacs	Cost Driver	Cost Driver Rate (₹)
Production Line Cost	2,310	60,000 Machine Hrs.	3,850 per hr. $\left( \frac{2,310 \text{ lacs}}{60,000 \text{ hrs.}} \right)$
Transportation Cost			
Delivery Related (60%)	540	640 Deliveries	84,375 per delivery $\left( \frac{540 \text{ lacs}}{640 \text{ delivery}} \right)$
Distance Related (40%)	360	2,25,000 Kms.	160 per km $\left( \frac{360 \text{ lacs}}{2,25,000 \text{ kms.}} \right)$

(i) **Forecast Total Cost using Activity Based Costing Principles**

Elements of Cost	₹
Material	4,75,000.00
Labour	2,50,000.00
Overhead	
Production Line Cost (₹ 3,850 × 6 hrs.)	23,100.00
Transportation Cost -	
Delivery Related $\left( \frac{₹ 84,375}{10 \text{ cars}} \right)$	8,437.50
Distance Related $\left( \frac{₹ 160 \times 50,000 \text{ kms}}{1,000 \text{ cars}} \right)$	8,000.00
Total	7,64,537.50

(ii) **Calculation of Cost Gap Between Forecast Total Cost and the Target Total Cost**

Particulars	Amount (₹)
Target Selling Price	9,75,000.00
Less: Operating Profit Margin (25%)	2,43,750.00
Target Cost (Target Selling Price – Operating Profit)	7,31,250.00
Forecast Total Cost	7,64,537.50
Cost Gap (₹ 7,64,537.50 – ₹ 7,31,250)	33,287.50

## Life Cycle Costing

Problem-25

In WM Ltd. the 'OB' equipment is about to be replaced either by 'CF' system or by an 'OF' system. Finance costs 12% a year and the other estimated costs are as follows:

	CF (₹)	OF (₹)
Initial Cost	28,000	40,000
Annual Operating Costs	24,000 p.a.	18,000 p.a.

**Required**

If the company expected the new system (either CF or OF) to last at least for 12 years, which system should be chosen?

 **Solution****Calculation of Life-cycle Costs**

	CF (₹)	OF (₹)
Initial Cost	28,000	40,000
Add: Annual Operating Costs	1,48,656 (₹24,000 × 6.194)	1,11,492 (₹18,000 × 6.194)
Total Life Cycle Costs	1,76,656	1,51,492

The annuity of 12% finance costs for 12 years is 6.194.

**Analysis**

When we compare only the initial cost, we will tend to purchase CF system, for its cheap acquisition cost. But when we compare the total life-cycle costs, the OF system is most preferable, for its lowest total life-cycle costs.

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**Problem-26**

*A company is planning a new product. Market research information suggests that 40,000 units of the product can be sold at a maximum of ₹ 25 per unit. The company seeks a minimum mark-up of 25% on product cost. It is estimated that the lifetime costs of the product will be as follows:*

- (1) *Research and development, design costs ₹ 1,50,000*
- (2) *Manufacturing costs ₹ 16 per unit*
- (3) *End of life costs ₹ 70,000*
- (4) *Promotion and capacity cost ₹ 20,000*

*Should the product be manufactured?*

 **Solution**

The new product can be sold into the market at a maximum of ₹ 25 per unit. The company also seeks a minimum mark-up of 25% on product cost, which means the product should have a target cost of ₹ 20 per unit. Calculation is as below:

Target Cost + 25% Mark-up on cost = ₹ 25

Or, Target Cost per unit = ₹ 20 per unit.

**Statement Showing "Life Cycle Cost *per unit*"**

Particulars of Cost	₹
Manufacturing Cost <i>per unit</i>	16.00
Add: - Research and Development, Design Cost $\left( \frac{₹ 1,50,000}{40,000 \text{ units}} \right)$	3.75
- End of Life Costs $\left( \frac{₹ 70,000}{40,000 \text{ units}} \right)$	1.75
- Promotion and Capacity Cost $\left( \frac{₹ 20,000}{40,000 \text{ units}} \right)$	0.50
<b>Total Life Cycle Cost <i>per unit</i></b>	<b>22.00</b>

The above life cycle cost of the proposed product is above the target cost of ₹ 20 per unit hence, the product should not be manufactured.

**Problem-27**

*P & G International Ltd. (PGIL) has developed a new product "K" which is about to be launched into the market and anticipates to sell 80,000 of these units at a sales price of ₹300 over the product's life cycle of four years. Data pertaining to product "K" are as follows:*

Costs of Design and Development of Molds, Dies, and Other Tools	₹8,25,000
Manufacturing Costs	₹125 per unit
Selling Costs	₹12,500 per year + ₹100 per unit
Administration Costs	₹50,000 per year
Warranty Expenses	5 Replacement Parts per 25 units at ₹10 per part ; 1 Visit per 500 units (Cost ₹ 500 per visit)

**Required**

- (i) Compute the product "K"'s 'Life Cycle Cost'.
- (ii) Suppose PGIL can increase sales volume by 25% through 10% reduction in selling price. Should PGIL choose the lower price?

 Solution

## (i) Statement Showing "K's Life Cycle Cost (80,000 units)"

Particulars	Amount (₹)
Costs of Design and Development of Molds, Dies, and Other Tools	8,25,000
Manufacturing Costs (₹125 × 80,000 units)	1,00,00,000
Selling Costs (₹100 × 80,000 units + ₹12,500 × 4)	80,50,000
Administration Costs (₹50,000 × 4)	2,00,000
Warranty (80,000 units / 25 units × 5 parts × ₹10)	1,60,000
(80,000 units / 500 units × 1 visit × ₹500)	80,000
Total Cost	1,93,15,000

## (ii) Statement Showing "K's Life Cycle Cost (1,00,000 units)"

Particulars	Amount (₹)
Costs of Design and Development of Molds, Dies, and Other Tools	8,25,000
Manufacturing Costs (₹125 × 1,00,000 units)	1,25,00,000
Selling Costs (₹100 × 1,00,000 units + ₹12,500 × 4)	1,00,50,000
Administration Costs (₹50,000 × 4)	2,00,000
Warranty (1,00,000 units / 25 units × 5 parts × ₹10)	2,00,000
(1,00,000 units / 500 units × 1 visit × ₹500)	1,00,000
Total Cost	2,38,75,000

## Statement Showing "K's Life Time Profit"

Particulars	Amount (₹)	Amount (₹)
	80,000 units	100,000 units
Sales	2,40,00,000 (80,000 × ₹300)	2,70,00,000 (1,00,000 × ₹270)
Less: Total Cost	1,93,15,000	2,38,75,000
Profit	46,85,000	31,25,000

## Decision

Reducing the price by 10% will decrease profit by 33% (₹15,60,000). Therefore, PGIL should not cut the price.

**Problem-28**

Y-Connections, China based firm, has just developed ultra-thintablet S-5 with few features like the ability to open two apps at the same time. This tablet cost ₹ 5,00,000 to develop; it has undergone extensive research and is ready for production. Currently, the firm is deciding on plant capacity, which could cost either ₹ 35,00,000 or ₹ 52,00,000. The additional outlay would allow the plant to increase capacity from 500 units to 750 units. The relevant data for the life cycle of the tablet at different capacity level are as under:

Expected Sales	500 units	750 units
Sale Price	₹79,600 per unit	₹69,600 per unit
Variable Selling Costs	10% of Selling Price	10% of Selling Price
Salvage Value - Plant	₹ 6,25,000	₹ 9,00,000
Profit Volume Ratio	40%	

**Required**

Advise Y-Connections, regarding the 'Optimal Plant Capacity' to install. The tablet's life cycle is two years.

Note: Ignore the time value of money.



**Solution**

**Workings**

**Statement Showing "Variable Manufacturing Cost per unit"**

Particulars of Costs	₹ / unit
Sales	79,600
Less: Contribution (40%)	31,840
Variable Cost	47,760
Less: Variable Selling Costs (₹79,600 × 0.1)	7,960
Variable Manufacturing Cost	39,800

**Statement Showing "Expected Profit"**

Particulars of Costs	('000) ₹ / unit	
	500 units	750 units
Sales	39,800 (₹79,600 × 500)	52,200 (₹69,600 × 750)

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Less: Variable Mfg. Cost	19,900 (₹39,800 × 500)	29,850 (₹39,800 × 750)
Less: Variable Selling Cost	3,980 (₹39,800 × 0.1)	5,220 (₹52,200 × 0.1)
Add: Salvage Value	625	900
Less: Cost of Plant	3,500	5,200
Net Profit	13,045	12,830

*Development cost is sunk and is not relevant.*

### Advice

Based on the above 'Expected Profit' statement which is purely based on *financial considerations* firm may go for high price – low volume i.e. 500 units level. However, *non-financial considerations* are also given due importance as they account for actions that may not contribute directly to profits in the short run but may contribute significantly to profits in long run. Here, it is important to note that life cycle of product is two years and there is no significant difference between the profits at both levels. In this scenario firm may opt the plant having high capacity not only to increase its market share but also to establish a long term brand image.

### Problem-29

*Great Eastern Appliances Ltd. (GEAL) manufactures consumer durable products in a very highly competitive market. GEAL is considering launching a new product 'Kitchen Care' into the market and gathered the following data:*

<i>Expected Market Price.....</i>	<i>₹5,000 per unit</i>
<i>Direct Material Cost.....</i>	<i>₹1,850 per unit</i>
<i>Direct Labour Cost.....</i>	<i>₹80 per hour</i>
<i>Variable Overhead Cost.....</i>	<i>₹1,000 per unit</i>
<i>Packing Machine Cost (specially to be purchased for this product)...</i>	<i>₹5,00,000</i>

*GEAL expects the selling price for the new product will continue throughout the product's life and a total of 1,000 units can be sold over the entire lifetime of the product.*

*Direct labour costs are expected to reduce as the volume of output increases due to the effects of 80% learning curve (index is -0.3219). The expected time to be taken for the first unit is 30 hours and the learning effect is expected to end after 250 units have been produced. Units produced after first 250 units will take the same time as the 250<sup>th</sup> unit.*

**Required**

- (i) Calculate the expected total labour hours over the life time of the product 'Kitchen Care'.
- (ii) Profitability of product 'Kitchen Care' that GEAL will earn over the life time of the product.
- (iii) Average target labour cost per unit over the life time of the product if GEAL requires average profit of ₹ 800 per unit, to achieve its long term objectives.

Note:  $250^{-0.3219} = 0.1691$ ,  $249^{-0.3219} = 0.1693$



**Solution**

- (i) Calculation of 'Total Labour Hours' over the Life Time of the Product 'Kitchen Care'

The average time per unit for 250 units is

$$Y_x = ax^b$$

$$Y_{250} = 30 \times 250^{-0.3219}$$

$$Y_{250} = 30 \times 0.1691$$

$$Y_{250} = 5.073 \text{ hours}$$

$$\begin{aligned} \text{Total time for 250 units} &= 5.073 \text{ hours} \times 250 \text{ units} \\ &= 1,268.25 \text{ hours} \end{aligned}$$

The average time per unit for 249 units is

$$Y_{249} = 30 \times 249^{-0.3219}$$

$$Y_{249} = 30 \times 0.1693$$

$$Y_{249} = 5.079 \text{ hours}$$

$$\begin{aligned} \text{Total time for 249 units} &= 5.079 \text{ hours} \times 249 \text{ units} \\ &= 1,264.67 \text{ hours} \end{aligned}$$

$$\begin{aligned} \text{Time for 250}^{\text{th}} \text{ unit} &= 1,268.25 \text{ hours} - 1,264.67 \text{ hours} \\ &= 3.58 \text{ hours} \end{aligned}$$

$$\begin{aligned} \text{Total Time for 1,000 units} &= (750 \text{ units} \times 3.58 \text{ hours}) + 1,268.25 \text{ hours} \\ &= 3,953.25 \text{ hours} \end{aligned}$$

## (ii) Profitability of the Product 'Kitchen Care'

Particulars	Amount (₹)	Amount (₹)
Sales (1,000 units)		50,00,000
Less: Direct Material	18,50,000	
Direct Labour (3,953.25 hours × ₹ 80)	3,16,260	
Variable Overheads (1,000 units × ₹1,000)	10,00,000	31,66,260
Contribution		18,33,740
Less: Packing Machine Cost		5,00,000
Profit		13,33,740

## (iii) Average 'Target Labour Cost' per unit

Particulars	Amount (₹)
Expected Sales Value	50,00,000
Less: Desired Profit (1,000 units × ₹ 800)	8,00,000
Target Cost	42,00,000
Less: Direct Material (1,000 units × ₹ 1,850)	18,50,000
Variable Cost (1,000 units × ₹ 1,000)	10,00,000
Packing Machine Cost	5,00,000
Target Labour Cost	8,50,000
Average Target Labour Cost per unit (₹ 8,50,000 ÷ 1,000 units)	850

## Problem-30

P & G International Ltd. (PGIL) has developed a new product 'α<sup>3</sup>' which is about to be launched into the market. Company has spent ₹ 30,00,000 on R&D of product 'α<sup>3</sup>'. It has also bought a machine to produce the product 'α<sup>3</sup>' costing ₹ 11,25,000 with a capacity of producing 1,100 units per week. Machine has no residual value.

The company has decided to charge price that will change with the cumulative numbers of units sold:

Cumulative Sales (units)	Selling Price ₹ per unit
0 to 2,200	750
2,201 to 7,700	600
7,701 to 15,950	525

15,951 to 59,950	450
59,951 and above	300

Based on these selling prices, it is expected that sales demand will be as shown below:

Weeks	Sales Demand per week (units)
1-10	220
11-20	550
21-30	825
31-70	1,100
71-80	880
81-90	660
91-100	440
101-110	220
Thereafter	NIL

Unit variable costs are expected to be as follows:

	₹ per unit
First 2,200 units	375
Next 13,750 units	300
Next 22,000 units	225
Next 22,000 units	188
Thereafter	225

PGIL uses just-in-time production system. Following is the total contribution statement of the product 'α<sup>3</sup>' for its Introduction and Growth phase:

	Introduction	Growth	
Weeks	1 - 10	11 - 30	
Number of units Produced and Sold	2,200	5,500	8,250
Selling Price per unit (₹)	750	600	525
Variable Cost per unit (₹)	375	300	300
Contribution per unit (₹)	375	300	225
Total Contribution (₹)	8,25,000	16,50,000	18,56,250

**Required**

- (i) Prepare the total contribution statement for each of the remaining two phases of the product's life cycle.
- (ii) Discuss Pricing Strategy of the product 'α<sup>3</sup>'.
- (iii) Find possible reasons for the changes in cost during the life cycle of the product 'α<sup>3</sup>'.

Note: Ignore the time value of money.

**Solution**

- (i) Total Contribution Statement

Statement Showing "Total Contribution- for remaining two phases"

Particulars	Maturity		Decline
	31 - 50	51 - 70	71 - 110
Weeks	31 - 50	51 - 70	71 - 110
Number of units Produced and Sold	22,000	22,000	22,000
Selling Price per unit (₹)	450	450	300
Less: Unit Variable Cost (₹)	225	188	225
Unit Contribution (₹)	225	262	75
Total Contribution (₹)	49,50,000	57,64,000	16,50,000

- (ii) Pricing Strategy for Product α<sup>3</sup>

PGIL is following the skimming price strategy that's why it has planned to launch the product α<sup>3</sup> initially with high price tag.

A skimming strategy may be recommended when a firm has incurred large sums of money on research and development for a new product.

In the problem, PGIL has incurred a huge amount on research and development. Also, it is very difficult to start with a low price and then raise the price. Raising a low price may annoy potential customers.

Price of the product α<sup>3</sup> is decreasing gradually stage by stage. This is happening because PGIL wants to tap the mass market by lowering the price.

- (iii) Possible Reasons for the changes in cost during the life cycle of the product 'α<sup>3</sup>'

Product life cycle costing involves tracing of costs and revenues of each product over several calendar periods throughout their entire life cycle. Possible reasons for the changes in cost during the life cycle of the product are as follows:

PGIL is expecting reduction in unit cost of the product  $\alpha^3$  over the life of product as a consequence of economies of scale and learning / experience curves.

Learning effect may be the possible reason for reduction in per unit cost if the process is labour intensive. When a new product or process is started, performance of worker is not at its best and learning phenomenon takes place. As the experience is gained, the performance of worker improves, time taken per unit reduces and thus his productivity goes up. The amount of improvement or experience gained is reflected in a decrease in cost.

Till the stage of maturity, PGIL is in the expansion mode. The PGIL may be able to take advantages of quantity discount offered by suppliers or may negotiate the price with suppliers.

Product  $\alpha^3$  has the least variable cost ₹188 in last phase of maturity stage; this is because a product which is in the mature stage may require less marketing support than a product which is in the growth stage so, there is a saving of marketing cost per unit.

Again the cost per unit of the product  $\alpha^3$  jumps to ₹225 in decline stage. As soon as the product reaches its decline stage, the need or demand for the product disappear and quantity discount may not be available. Even PGIL may have to incur heavy marketing expenses for stock clearance.

**Workings**

**Statement of Cumulative Sales along with Sales Price and Variable Cost**

Weeks	Demand <i>per week</i>	Total Sales	Cumulative Sales	Selling Price per unit (₹)	Variable Cost per unit (₹)
1 - 10	220	2,200	2,200	750	375
11 - 20	550	5,500	7,700	600	300
21 - 30	825	8,250	15,950	525	300
31 - 50	1,100	22,000	37,950	450	225
51 - 70	1,100	22,000	59,950	450	188
71 - 80	880	8,800	68,750	300	225
81 - 90	660	6,600	75,350	300	225
91 - 100	440	4,400	79,750	300	225
101 - 110	220	2,200	81,950	300	225

## Just In Time

### Problem-31

*United Video International Company (UVIC) sells package of blank video tapes to its customer. It purchases video tapes from Indian Tape Company (ITC) @ ₹ 140 a package. ITC pays all freight to UVIC. No incoming inspection is necessary because ITC has a superb reputation for delivery of quality merchandise. Annual demand of UVIC is 13,000 packages. UVIC requires 15% annual return on investment. The purchase order lead time is two weeks. The purchase order is passed through Internet and it costs ₹ 2 per order. The relevant insurance, material handling etc ₹ 3.10 per package per year. UVIC has to decide whether or not to shift to JIT purchasing. ITC agrees to deliver 100 packages of video tapes 130 times per year (5 times every two weeks) instead of existing delivery system of 1,000 packages 13 times a year with additional amount of ₹ 0.02 per package. UVIC incurs no stock out under its current purchasing policy. It is estimated UVIC incurs stock out cost on 50 video tape packages under a JIT purchasing policy. In the event of a stock out, UVIC has to rush order tape packages which costs ₹ 4 per package. Comment whether UVIC should implement JIT purchasing system.*

*Hindustan Tape Company (HTC) also supplies video tapes. It agrees to supply @ ₹ 136 per package under JIT delivery system. If video tape purchased from HTC, relevant carrying cost would be ₹ 3 per package against ₹ 3.10 in case of purchasing from ITC. However HTC doesn't enjoy so sterling a reputation for quality. UVIC anticipates following negative aspects of purchasing tapes from HTC.*

— *To incur additional inspection cost of 5 paise per package.*

*Average stock out of 360 tapes packages per year would occur, largely resulting from late deliveries. HTC cannot rush order at short notice. UVIC anticipates lost contribution margin per package of ₹ 8 from stock out.*

— *Customer would likely return 2% of all packages due to poor quality of the tape and to handle this return an additional cost of ₹ 25 per package.*

### **Required**

*Comment whether UVIC places order to HTC.*

 Solution

(i) **Comparative 'Statement of Cost' for  
Purchasing from ITC under 'Current Policy' & 'JIT'**

Particulars	Current Policy (₹)	JIT (₹)
Purchasing Cost	18,20,000 (13,000 Packages × ₹140)	18,20,260 (13,000 Packages × ₹140.02)
Ordering Cost	26.00 (₹2 × 13 Orders)	260.00 (₹2 × 130 Orders)
Opportunity / Carrying Cost	10,500.00 (1/2 × 1,000 Packages × ₹140 × 15%)	1,050 (1/2 × 100 Packages × ₹ 140.02 × 15%)
Other Carrying Cost (Insurance, Material Handling etc)	1,550.00 (1/2 × 1,000 Packages × ₹3.10)	155.00 (1/2 × 100 Packages × ₹3.10)
Stock Out Cost	---	200 (50 Packages × ₹4.00)
<b>Total Relevant Cost</b>	<b>18,32,076</b>	<b>18,21,925</b>

**Comments**

As may be seen from above, the relevant cost under the JIT purchasing policy is lower than the cost incurred under the existing system. Hence, a JIT purchasing policy should be adopted by the company.

(ii) **'Statement of Cost' for Purchasing from HTC under 'JIT'**

Particulars	JIT (₹)
Purchasing Cost	17,68,000 (13,000 Packages × ₹136)
Ordering Cost	260.00 (₹2 × 130 Orders)
Opportunity / Carrying Cost	1,020 (1/2 × 100 Packages × ₹ 136 × 15%)

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Other Carrying Cost (Insurance, Material Handling etc)	150.00 (1/2 × 100 Packages × ₹3.00)
Inspection Cost	650 (13,000 Packages × ₹0.05)
Stock Out Cost	2,880 (360 Packages × ₹8.00)
Customer Return Cost	6,500 (13,000 Packages × 2% × ₹25.00)
Total Relevant Cost	17,79,460

### Comments

The comparative costs are as follows:

Under Current Policy ₹ 18,32,076

Under Purchase under JIT from ITC ₹ 18,21,925

Under Purchase under JIT from HTC ₹ 17,79,460

Packages should be bought from HTC under JIT as it is the *cheapest*.

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### Problem-32

*KP Ltd. (KPL) manufactures and sells one product called "KEIA". Managing Director is not happy with its current purchasing and production system. There has been considerable discussion at the corporate level as to use of 'Just in Time' system for "KEIA". As per the opinion of managing director of KPL Ltd. –*

*"Just-in-time system is a pull system, which responds to demand, in contrast to a push system, in which stocks act as buffers between the different elements of the system such as purchasing, production and sales. By using Just in Time system, it is possible to reduce carrying cost as well as other overheads".*

*KPL is dependent on contractual labour which has efficiency of 95%, for its production. The labour has to be paid for minimum of 4,000 hours per month to which they produce 3,800 standard hours.*

*For availing services of labour above 4,000 hours in a month, KPL has to pay overtime rate which is 45% premium to the normal hourly rate of ₹110 per hour. For avoiding this overtime payment, KPL in its current production and purchase plan utilizes full available normal working hours so that the higher inventory levels in the month of lower demand would be able to meet sales of month with higher demand level. KPL has determined that the cost of holding inventory is ₹70 per month for each standard hour of output that is held in inventory.*

KPL has forecast the demand for its products for the first six months of year 2014 as follows:

Month	Demand (Std. Hrs.)
Jan'14	3,150
Feb'14	3,760
Mar'14	4,060
Apr'14	3,350
May'14	3,650
Jun'14	4,830

Following other information is given:

- (i) All other production costs are either fixed or are not driven by labour hours worked.
- (ii) Production and sales occur evenly during each month and at present there is no stock at the end of Dec'13.
- (iii) The labour are to be paid for their minimum contracted hours in each month irrespective of any purchase and production system.

**Required**

As a chief accountant you are requested to comment on managing director's view.

**Solution**

**Workings**

**Statement Showing 'Inventory Holding Cost' under Current System**

Particulars	Jan	Feb	Mar	Apr	May	Jun
Opening Inventory* (A)	---	650	690	430	880	1,030
Add: Production*	3,800	3,800	3,800	3,800	3,800	3,800
Less: Demand*	3,150	3,760	4,060	3,350	3,650	4,830
Closing Inventory* (B)	650	690	430	880	1,030	-
Average Inventory $\left(\frac{A+B}{2}\right)$	325	670	560	655	955	515
Inventory Holding Cost @ ₹70	22,750	46,900	39,200	45,850	66,850	36,050

(\*) in terms of standard labour hours

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$$\begin{aligned} \text{Inventory Holding Cost for the six months} &= ₹2,57,600 \\ &(\text{₹}22,750 + \text{₹}46,900 + \text{₹}39,200 + \\ &\text{₹}45,850 + \text{₹}66,850 + \text{₹}36,050) \end{aligned}$$

### Calculation of Relevant Overtime Cost under JIT System

Particulars	Jan	Feb	Mar	Apr	May	Jun
Demand*	3,150	3,760	4,060	3,350	3,650	4,830
Production*	3,150	3,760	4,060	3,350	3,650	4,830
Normal Availability*	3,800	3,800	3,800	3,800	3,800	3,800
Shortage (=Overtime*) (C)	---	---	260	---	---	1,030
Actual Overtime Hours $\left(\frac{C}{0.95}\right)$	---	---	273.68	---	---	1,084.21
Overtime Payment @ ₹159.50 [110+45%]	---	---	43,652	---	---	1,72,931

(\*) in terms of standard labour hours

$$\begin{aligned} \text{Total Overtime payment} &= ₹2,16,583 \\ &(\text{₹}43,652 + \text{₹}1,72,931) \end{aligned}$$

$$\text{Therefore, saving in JIT system} = ₹2,57,600 - ₹2,16,583 = ₹41,017$$

### Comments

Though KPL is saving ₹41,017 by changing its production system to Just-in-time but it has to consider other factors as well before taking any final call which are as follows:-

- (i) KPL has to ensure that it receives materials from its suppliers on the exact date and at the exact time when they are needed. Credentials and reliability of supplier must be thoroughly checked.
- (ii) To remove any quality issues, the engineering staff must visit supplier's sites and examine their processes, not only to see if they can reliably ship high-quality parts but also to provide them with engineering assistance to bring them up to a higher standard of product.
- (iii) KPL should also aim to improve quality at its process and design levels with the purpose of achieving "Zero Defects" in the production process.
- (iv) KPL should also keep in mind the efficiency of its work force. KPL must ensure that labour's learning curve has reached at steady rate so that they are capable of performing a variety of operations at effective and efficient manner. The workforce must be completely retrained and focused on a wide range of activities.

**Problem-33**

*Innovation Ltd. has entered into a contract to supply a component to a company which manufactures electronic equipments.*

*Expected demand for the component will be 70,000 units totally for all the periods. Expected sales and production cost will be*

Period	1	2	3	4
Sales (units)	9,500	17,000	18,500	25,000
Variable cost per unit	30	30	32.50	35

*Total fixed overheads are expected to be ₹14 lakhs for all the periods.*

*The production manager has to decide about the production plan.*

*The choices are:*

Plan 1: *Produce at a constant rate of 17,500 units per period. Inventory holding costs will be ₹ 6.50 per unit of average inventory per period.*

Plan 2: *Use a just-in-Time (JIT) system*

*Maximum capacity per period normally.....18,000 units*

*It can produce further up to 10,000 units per period in overtime.*

*Each unit produced in overtime would incur additional cost equal to 30% of the expected variable cost per unit of that period.*

*Assume zero opening inventory.*

**Required**

- (i) *Calculate the incremental production cost and the savings in inventory holding cost by JIT production system.*
- (ii) *Advise the company on the choice of a plan.*

**Solution**

- (i) **Workings**

**Statement Showing 'Inventory Holding Cost' under Plan 1**

Particulars	Pd. 1	Pd. 2	Pd. 3	Pd.4
Opening Inventory <span style="float: right;">...(A)</span>	---	8,000	8,500	7,500
Add: Production	17,500	17,500	17,500	17,500
Less: Demand/ Sales	9,500	17,000	18,500	25,000

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Closing Inventory ... (B)	8,000	8,500	7,500	---
Average Inventory $\left(\frac{A+B}{2}\right)$	4,000	8,250	8,000	3,750
Inventory Holding Cost @ ₹6.50	26,000	53,625	52,000	24,375

Inventory Holding Cost for the four periods = ₹1,56,000  
 (₹26,000 + ₹53,625 + ₹52,000 + ₹24,375)

Statement Showing 'Additional Cost-Overtime' under Plan 2 (JIT System)

Particulars	Pd. 1	Pd. 2	Pd. 3	Pd.4
Demand/ Sales	9,500	17,000	18,500	25,000
Production in Normal Time	9,500	17,000	18,000	18,000
Production in Over Time ... (A)	---	---	500	7,000
Variable Cost per unit	30.00	30.00	32.50	35.00
Additional Cost – Overtime per unit ... (B) (@ 30% of Variable Cost)	9.00	9.00	9.75	10.50
Additional Cost – Overtime ... (A) × (B)	---	---	4,875	73,500

Total Additional Payment (Overtime) = ₹78,375  
 (₹4,875 + ₹73,500)

Statement Showing 'Additional Variable Cost\*' under Plan 2 (JIT System)

Particulars	Pd. 1	Pd. 2	Pd. 3	Pd.4	Total
Production (Plan 1)	17,500	17,500	17,500	17,500	70,000
Variable Cost ... (A)	5,25,000	5,25,000	5,68,750	6,12,500	22,31,250
Production (Plan 2, JIT)	9,500	17,000	18,500	25,000	70,000
Variable Cost ... (B)	2,85,000	5,10,000	6,01,250	8,75,000	22,71,250
Total				... (B) – (A)	40,000

\* excluding overtime cost

Incremental Production Cost in JIT System = ₹78,375 + ₹40,000  
 = ₹1,18,375

Therefore, Saving in JIT System (Net) = ₹1,56,000 – ₹1,18,375  
 = ₹37,625

(ii) **Advice**

Though Innovation Ltd is saving ₹37,625 by changing its production system to Just-in-time but it has to consider *other factors* as well before taking any final call which are as follows:-

- Innovation Ltd has to ensure that it receives materials from its suppliers on the exact date and at the exact time when they are needed. Credentials and reliability of supplier must be thoroughly checked.
- To remove any quality issues, the engineering staff must visit supplier's sites and examine their processes, not only to see if they can reliably ship high-quality parts but also to provide them with engineering assistance to bring them up to a higher standard of product.
- Innovation Ltd should also aim to improve quality at its process and design levels with the purpose of achieving "Zero Defects" in the production process.
- Innovation Ltd should also keep in mind the efficiency of its work force. Innovation Ltd must ensure that labour's learning curve has reached at steady rate so that they are capable of performing a variety of operations at effective and efficient manner. The workforce must be completely retrained and focused on a wide range of activities.

## JIT Production System > Backflush Costing System

**Problem-34**

Napier Company uses a backflush costing system with three trigger points:

- (a) Purchase of Direct Materials
- (b) Completion of Good Finished Units of Product
- (c) Sales of Finished Goods

You are provided with the following information for July 2016.

Direct Materials Purchased	₹2,64,000	Conversion Costs Allocated	₹1,20,000
Direct Materials Used	₹2,55,000	Costs Transferred to Finished Goods	₹3,75,000
Conversion Costs Incurred	₹1,26,600	Cost of Goods Sold	₹3,57,000

**Required**

- (i) Prepared journal entries for July (without disposing of under allocated/ over allocated conversion costs).
- (ii) Under an ideal JIT production system, how would the amounts in your journal entries change from the journal entries in requirement (i)?

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### Note

- There are no beginning inventories.
- Assume there are no direct material variances.



### Solution

- (i) Journal Entries for July are as follows

	₹	₹
E.1 Material and In-Process Inventory Control Accounts Payable Control (Direct Materials Purchased)	2,64,000	2,64,000
E.2 Conversion Costs Control Various Accounts (Conversion Cost Incurred)	1,26,600	1,26,600
E.3 Finished Goods Control Materials and In-Process Inventory Control Conversion Costs Allocated (Standard cost of finished goods completed)	3,75,000	2,55,000 1,20,000
E.4 Cost of Goods Sold Finished Goods Control (Standard cost of finished goods sold)	3,57,000	3,57,000

- (ii) Zero inventory is the goal of an *ideal* JIT production system. Accordingly, entry (E.3) would be ₹3,57,000 finished goods production, not ₹3,75,000. If the marketing division could only sell goods costing ₹3,57,000, the JIT production system would call for direct materials purchases and conversion costs lower than ₹2,64,000 and ₹1,26,600, respectively, in entries (E.1) and (E.2).



When a JIT system is created, the amount of inventory retained in a company drops continuously. Raw materials inventory is reduced because suppliers deliver only small quantities of parts as and when they are needed. Work-in-process inventory drops because the conversion to machine cells and the use of Kanban Cards greatly reduces the need to pile up inventory between machines. Finally, finished goods inventory drops because inventory is produced only when there are orders in hand from customers (though finished goods inventories are also allowed to build if a company experiences high seasonal sales). Consequently, the cost of maintaining inventory declines, which in turn reduces the overhead costs associated with inventories that are charged to products.

## Theory of Constraints

### Problem-35

*BTS Ltd. produces three products A, B and C. The following information is available for a period:*

	A	B	C
Contribution (per unit)	₹ 30	₹ 25	₹ 15
[Sales – Direct materials]			

*Machine hours required per unit of production:*

	Hours			Throughout Accounting Ratio
	A	B	C	
Machine 1	10	2	4	133.33%
Machine 2	15	3	6	200.00%
Machine 3	5	1	2	66.67%

*Estimated sales demand for A, B and C are 500 units each and machine capacity is limited to 6,000 hours for each machine.*

### Required

*Analyse the above information and apply theory of constraints process to remove the constraints. How many units of each product will be made?*

 Solution

Throughout Accounting Ratio is *highest* for 'Machine 2'. Accordingly 'Machine 2' is the bottleneck. Total 6,000 'Machine 2' hours are available.

Contribution *per unit* of Bottleneck Machine hour

Particulars	A	B	C
Contribution <i>per unit</i> (₹) ... (A)	30	25	15
'Machine 2' Hours ... (B)	15	3	6
Contribution <i>per</i> 'Machine 2' hours ... (C) = (A) / (B)	2	8.33	2.50
Ranking ... (D)	3	1	2
Maximum Demand ... (E)	500	500	500
'Machine 2' Hours Required ... (F) = (B) x (E)	7,500	1,500	3,000
'Machine 2' Hours Available ... (G)	1,500* (Balance)	1,500	3,000
Units ... (H) = (G) / (B)	100	500	500

(\*) [6,000 hrs – 1,500 hrs – 3,000hrs]

## Problem-36

Phi Ltd. produces 4 products P, Q, R and S by using three different machines X, Y and Z. Each machine capacity is limited to 6,000 hours per month. The details given below are for July, 2013:

Particulars	P	Q	R	S
Selling Price p.u. (₹)	10,000	8,000	6,000	4,000
Variable Cost p.u. (₹)	7,000	5,600	4,000	2,800
Machine Hours Required p.u.				
Machine X	20	12	4	2
Machine Y	20	18	6	3
Machine Z	20	6	2	1
Expected Demand (units)	200	200	200	200

**Required**

- (i) Find out the bottleneck activity.

- (ii) Allocate the machine hours on the basis of the bottleneck.
- (iii) Ascertain the profit expected in the month if the monthly fixed cost amounts to ₹9,50,000.
- (iv) Calculate the unused spare hours of each machine.

 **Solution**

(i)

Mach.	Time Required for Products (Hours)				Total Time	Time Avail.	Machine Utilization
	P	Q	R	S			
X	4,000 (200 units × 20 hours)	2,400 (200 units × 12 hours)	800 (200 units × 4 hours)	400 (200 units × 2 hours)	7,600	6,000	126.67%
Y	4,000 (200 units × 20 hours)	3,600 (200 units × 18 hours)	1,200 (200 units × 6 hours)	600 (200 units × 3 hours)	9,400	6,000	156.67%
Z	4,000 (200 units × 20 hours)	1,200 (200 units × 6 hours)	400 (200 units × 2 hours)	200 (200 units × 1 hours)	5,800	6,000	96.67%

Since Machine Y has the *highest machine utilization* it represents the bottleneck activity. Hence Product Ranking & Resource Allocation should be based on Contribution/Machine Hour of Machine Y.

(ii)

Allocation of Resources						
Particulars	P	Q	R	S	Machine Utilization	Spare Capacity
Selling Price <i>per unit</i> (₹)	10,000	8,000	6,000	4,000		
Variable Cost <i>per unit</i> (₹)	7,000	5,600	4,000	2,800		
Contribution <i>per unit</i> (₹)	3,000	2,400	2,000	1,200		
Time Required in Machine 'Y' (hrs.)	20	18	6	3		

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Contribution per Machine Hour (₹)	150	133.33	333.33	400		
Rank	III	IV	II	I		
Allocation of Machine 'Y' time (hrs.)	4,000 (200 units × 20 hrs.)	200 (Balance)	1,200 (200 units × 6 hrs.)	600 (200 units × 3 hrs.)	6,000	
Production (units)	200	11.11 (200 hrs. / 18 hrs.)	200	200		
Allocation of Machine 'X' time (hrs.)	4,000 (200 units × 20 hrs.)	133.32 (11.11 units × 12 hrs.)	800 (200 units × 4 hrs.)	400 (200 units × 2 hrs.)	5,333.32	666.68
Allocation of Machine 'Z' time (hrs.)	4,000 (200 units × 20 hrs.)	66.66 (11.11 units × 6 hrs.)	400 (200 units × 2 hrs.)	200 (200 units × 1 hr.)	4,666.66	1,333.34

(iii) Calculation of Expected Profit

Particulars	Amount (₹)
P (200 units × ₹ 3,000)	6,00,000
Q (11.11 units × ₹ 2,400)	26,664
R (200 units × ₹ 2,000)	4,00,000
S (200 units × ₹ 1,200)	2,40,000
Total Contribution	12,66,664
Less: Fixed Cost	9,50,000
Expected Profit	3,16,664

(iv) Unused Spare Hours

Machine 'X'

Particulars	Amount (₹)
Machine Hours Available	6,000.00 hrs.
Less: Machine Hours Utilized	5,333.32 hrs.
Spare Hours	666.68 hrs.

Machine 'Z'

Particulars	Amount (₹)
Machine Hours Available	6,000.00 hrs.
Less: Machine Hours Utilized	4,666.66 hrs.
Spare Hours	1,333.34 hrs.



While calculating Production (units) of Product 'Q' on the basis of allocated hours, round figure (complete units) can also be considered and rest of the solution will be changed accordingly.

**Problem-37**

H. Ltd. manufactures three products. The material cost, selling price and bottleneck resource details per unit are as follows:

Particulars	Product X	Product Y	Product Z
Selling Price (₹)	66	75	90
Material and Other Variable Cost (₹)	24	30	40
Bottleneck Resource Time (Minutes)	15	15	20

Budgeted factory costs for the period are ₹ 2,21,600. The bottleneck resources time available is 75,120 minutes per period.

**Required**

- (i) Company adopted throughput accounting and products are ranked according to 'product return per minute'. Select the highest rank product.

(ii) Calculate throughput accounting ratio and comment on it.

 Solution

(i) Calculation of Rank According to 'Product Return *per minute*'

Particulars	X	Y	Z
Selling Price	66	75	90
Variable Cost	24	30	40
Throughput Contribution	42	45	50
Minutes <i>per unit</i>	15	15	20
Contribution <i>per minute</i>	2.8	3	2.5
Ranking	II	I	III

(ii) Ranking Based on 'TA Ratio'

Contribution <i>per minute</i>	2.80	3.00	2.50
Factory Cost <i>per minute</i> (2,21,600 / 75,120)	2.95	2.95	2.95
TA Ratio (Cont. <i>per minute</i> / Cost <i>per minute</i> )	0.95	1.02	0.85
Ranking Based on TA Ratio	II	I	III

Comment

Product Y yields more contribution compared to average factory contribution per minute, whereas X and Z yield less.

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# SECTION - C

## Total Quality Management

### Problem-1

Quality products can be determined by using a few of the dimensions of quality. Identify the following under the appropriate dimension:

- (i) Consistency of performance over time.
- (ii) Primary product characteristics.
- (iii) Exterior finish of a product
- (iv) Useful life of a product.



### Solution

#### Quality of Products with Appropriate Dimension

Sl. No	Quality of Products (Examples)	Dimension
(i)	Consistency of performance over time	Reliability
(ii)	Primary product characteristics	Performance
(iii)	Exterior finish of a product	Aesthetics
(iv)	Useful like of a product	Durability

### Problem-2

Classify the following items under appropriate categories of equality costs viz. Prevention Costs, appraisal Cost, Internal Failure Costs and External Failure costs:

- (i) Rework
- (ii) Scrap
- (iii) Warranty Repairs
- (iv) Revenue loss
- (v) Repair to manufacturing equipment
- (vi) Discount on defective sale
- (vii) Establishment of quality circles
- (viii) Packaging inspection

**Solution**

(i)	Rework	----- Internal Failure
(ii)	Scrap	----- Internal Failure
(iii)	Warranty Repairs	----- External Failure
(iv)	Revenue Loss	----- External Failure
(v)	Repairs to Manufacturing Equipment	----- Internal Failure
(vi)	Discount on Defective Sales	----- External Failure
(vii)	Establishment of Quality Circles	----- Prevention Cost
(viii)	Packaging Inspection	----- Appraisal Cost

**Problem-3**

Classify the following items under appropriate categories of quality costs, viz., Prevention Costs (PC), Appraisal Costs (AC), Internal Failure Costs (IFC) and External Failure Costs (EFC):

- (i) Unplanned replacement to customers
- (ii) Correction of a bank statement
- (iii) Design review
- (iv) Equipment accuracy check
- (v) Staff training
- (vi) Reprocessing of a loan operation
- (vii) Product liability warranty
- (viii) Product acceptance
- (ix) Wastage of material
- (x) Planned maintenance of equipment

(You may opt for the following format and fill in the appropriate Roman numerals under each column)

Cost →	PC	AC	IFC	EFC
Q. Nos. →	x	x	x	x

 Solution

Appropriate Categories of Quality Costs

Costs	PC	AC	IFC	EFC
Q. Nos.	(iii)	(iv)	(ii)	(i)
	(v)	(viii)	(vi)	---
	(x)	---	(ix)	(vii)

**Problem-4**

*A Ltd. is going to introduce Total Quality Management (TQM) in its company. State whether and why the following are valid or not for the successful implementation of TQM.*

- (i) *Some departments serve both the external and internal customers. These departments have been advised to focus on satisfying the needs of the external customers.*
- (ii) *Hold a training program at the beginning of a production cycle to ensure the implementation of TQM.*
- (iii) *Implement Management by Objectives for faster achievement of TQM.*
- (iv) *Appoint the Head of each department as the person responsible to develop improvement strategies and performance measures.*
- (v) *Eliminate wastage of time by avoiding documentation and procedures.*

 Solution

Point	Valid/ Invalid	Reason
(i)	Invalid	TQM advocates focus to be given on both external and internal customers. Hence, focus satisfying the needs of the external customers only will not be valid for the successful implementation of TQM.
(ii)	Valid	Training at the beginning would improve productivity by bringing standardization in work habits and eliminating variations in production.
(iii)	Invalid	For implementation of TQM, Management by Objectives should be eliminated as targets of production will encourage delivery of poor quality goods and thus will defeat the collective nature of TQM.
(iv)	Invalid	Appointing the head of each department as the responsible person is not valid for the successful implementation of TQM as Total Employee Involvement (TIE) principle is an important part of TQM.

(v)	Invalid	Documentation, procedures and awareness of current best practice are essential in TQM implementation. If documentation and procedures are in place then only improvement can be monitored & measured and consequently deficiency can be corrected.
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## Activity Based Costing

### Problem-5

Indicate 2 activity drivers in respect of each of the following activity cost pools:

- (i) Manufacturing cost
- (ii) Human resources cost
- (iii) Marketing and sales costs
- (iv) Accounting costs



### Solution

#### Activity Cost Driver for Activity Cost Pools

S.No.	Activity Cost Pools	Activity Drivers
(i)	Manufacturing Cost	1. Number of machine hours
		2. Number of direct labor hours
		3. Number of field support visits
		4. Number of jobs scheduled
		5. Number of machine setups
		6. Number of maintenance work orders
		7. Number of parts in product
		8. Number of parts in stock
		9. Number of price negotiations
		10. Number of purchase orders
		11. Number of scheduling changes
		12. Number of shipments
(ii)	Human Resource Cost	1. Number of employee
		2. Number of training Hours
		3. Number of benefit changes
		4. Number of insurance claims

		5. Number of pension changes
		6. Number of recruiting contacts
(iii)	Marketing and Sales Cost	1. Number of customer service contacts
		2. Number of orders processed
		3. Number of sales contact made
		4. Number of advertisement
		5. Number of sales personnel
(iv)	Accounting Cost	1. Number of billings
		2. Number of cash receipts
		3. Number of check payments
		4. Number of general ledger entries
		5. Number of reports issued
		6. Number of responsibility centre

**Problem-6**

'SM' hospital is a primary medical care facility and trauma center that serves National Capital Territory. The hospital offers all the medical/ surgical services of typical small hospital.

**Required**

- (i) Using your (limited, moderate, or in-depth) knowledge of a hospital's operations, identify 4 key activities that are important.
- (ii) For each of the activities, suggest an appropriate cost driver.



**Solution**

**Activities / Cost Drivers for 'SM' hospital**

Activities	Cost Driver
Purchase of medical supplies, maintain records/inventory (dispense medications)	Number of medication orders filled
Reservation/Scheduling, inpatient registration, billing and insurance verification (admit patients)	Number of patients admitted
Prepare patient, perform ECG procedure, interpret results (administer ECG tests)	Number of tests
Obtain specimens, perform test, report results (administer laboratory tests)	Number of test by type

**Problem-7**

State with a brief reason whether you would recommend an activity based system of costing in each of the following independent situations:

- (i) Company K produces one product. The overhead costs mainly consist of depreciation.
- (ii) Company L produces 5 different products using different production facilities.
- (iii) A consultancy firm consisting of lawyers, accountants and computer engineers provides management consultancy services to clients.
- (iv) Company S produces two different labour intensive products. The contribution per unit in both products is very high. The BEP is very low. All the work is carried on efficiently to meet the target costs.

**Solution**

Sl. No	Description	Recommend ABC (Yes / No)	Reasons
(i)	K produces one product. Overhead is mainly depreciation.	No	<ul style="list-style-type: none"> <li>▪ One product situation. For allocation of overhead, ABC is not required.</li> <li>▪ ABC for cost reduction not beneficial since most of the overhead is depreciation.</li> </ul>
(ii)	L produces 5 different products with different facilities.	Yes	<ul style="list-style-type: none"> <li>▪ Multi product situation. ABC is required for allocation of overhead.</li> <li>▪ ABC is necessary for pricing.</li> <li>▪ Cost drivers are likely to be different.</li> <li>▪ Cost reduction may be possible.</li> <li>▪ Production facilities are different.</li> </ul>
(iii)	Professional services – lawyers / accountants / computer engineers.	Yes	<ul style="list-style-type: none"> <li>▪ Variety of services. Hence ABC is required for cost allocation.</li> <li>▪ Services are very different.</li> <li>▪ ABC is necessary for pricing.</li> <li>▪ Cost reduction possible.</li> </ul>
(iv)	S produces 2 different labour intensive products. High unit contribution	No	<ul style="list-style-type: none"> <li>▪ Different products, but labour intensive. Hence, overhead allocation based on readily traceable direct labour cost will be accurate. Hence,</li> </ul>

	and efficient operations.		<p>ABC not required for cost allocation.</p> <ul style="list-style-type: none"> <li>▪ Low BEP level implies low level of fixed cost as a % of sale price or as a % of total cost.</li> <li>▪ Many fixed cost activity drivers are likely to align with the direct labour costs. Hence not required for cost allocation.</li> <li>▪ Efficient operation. Hence ABC not required even for cost reduction or ABC management.</li> </ul>
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**Problem-8**

State whether each of the following independent activities is value-added or non-value-added:

- (i) Polishing of furniture used by a systems engineer in a software firm.
- (ii) Maintenance by a software company of receivables management software for a banking company.
- (iii) Painting of pencils manufactured by a pencil factory.
- (iv) Cleaning of customers' computer key boards by a computer repair centre.
- (v) Providing, brake adjustments in cars received for service by a car service station.



**Solution**

Sl. No	Item	Value Added / Non Value Added
(i)	Polishing furniture used by a Systems Engineer in a software firm.	Non-Value Added
(ii)	Maintenance by a software company of receivables management software for a banking company.	Value-Added
(iii)	Painting of pencils manufactured by a pencil factory.	Value-Added
(iv)	Customers' computer key board cleaning by a computer repair centre.	Value-Added
(v)	Providing brake adjustments in cars for repairs by a care service station.	Value-Added

## Target Costing

### Problem-9

State whether and why the following statements are valid or not valid:

- (i) Target costing is not applicable to a monopoly market.
- (ii) Target costing ignores non-value added activities.



### Solution

#### Target Costing – VALID or NOT VALID

Sl. No	Statement	Valid or Not valid
(i)	Target costing is not applicable to a monopoly market.	Valid, Target costing is applied where the price is market determined and in the existence of competitive environment. In monopoly market, a firm is a price maker hence, target costing method is not applicable to a monopoly market.
(ii)	Target costing ignores non-value added activities.	Valid, In case of target costing the aim is to confine the total cost to set target. To achieve this target cost figure, <i>non-value added activities are eliminated and hence ignored.</i>

## Target Costing > Kaizen Costing

### Problem-10

*M. India Ltd. (MIL) is an automobile manufacturer in India and a subsidiary of Japanese automobile and motorcycle manufacturer Leon. It manufactures and sells a complete range of cars from the entry level to the hatchback to sedans and has a present market share of 22% of the Indian passenger car markets. MIL uses a system of standard costing to set its budgets. Budgets are set semi-annually by the Finance department after the approval of the Board of Directors at MIL. The Finance department prepares variance reports each month for review in the Board of Directors meeting, where actual performance is compared with the budgeted figures. Mr. Suzuki, group CEO of the Leon is of the opinion that Kaizen costing method should be implemented as a system of planning and control in the MIL.*

#### Required

*Recommend key changes vital to MIL's planning and control system to support the adoption of 'Kaizen Costing Concepts'.*

 Solution

Kaizen Costing emphasizes on *small but continuous improvement*. Targets once set at the beginning of the year or activities are *updated continuously* to reflect the improvement that has already been achieved and that are yet to be achieved.

The suggestive changes which are required to be adopted Kaizen Costing concepts in MIL are as follows:

*Standard Cost Control System to Cost Reduction System:* Traditionally Standard Costing system assumes stability in the current manufacturing process and standards are set keeping the normal manufacturing process into account thus the whole effort is on to meet performance cost standard. On the other hand Kaizen Costing believes in continuous improvements in manufacturing processes and hence, the goal is to achieve cost reduction target. The first change required is the standard setting methodology i.e. from earlier Cost Control System to Cost Reduction System.

*Reduction in the periodicity of setting Standards and Variance Analysis:* Under the existing planning and control system followed by the MIL, standards are set semi-annually and based on these standards monthly variance reports are generated for analysis. But under Kaizen Costing system cost reduction targets are set for small periods say for a week or a month. So the period covered under a standard should be reduced from semi-annually to monthly and the current practice of generating variance reports may be continued or may be reduced to a week.

*Participation of Executives or Workers in standard setting:* Under the Kaizen Costing system participation of workers or executives who are actually involved in the manufacturing process are highly appreciated while setting standards. So the current system of setting budgets and standards by the Finance department with the mere consent of Board of Directors required to be changed.

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**Problem-11**

*ABC Ltd. is planning to introduce Kaizen Costing approach in its manufacturing plant. State whether and why the following are Valid or Not in respect of Kaizen Costing.*

- (i) *VP (Finance) is of the view that company has to make a huge initial investment to bring a large scale modification in production process.*
- (ii) *Head (Personnel) has made a point that introduction of Kaizen Costing does not eliminate the training requirement of employees.*
- (iii) *General Manager (Manufacturing) firmly believes that only shop floor employees and workers' involvement is prerequisite of Kaizen Costing approach.*

- (iv) *Manager (Operations) has concerns about creation of confusion among employees and workers regarding their roles and degradation in quality of production.*



**Solution**

- (i) **Invalid:** Kaizen Costing is the system of cost reduction procedures which involves making small and continuous improvements to the production processes rather than innovations or large-scale investment.
- (ii) **Valid:** The training of employees is very much a long-term and ongoing process in the Kaizen costing approach. Training enhances the abilities of employees.
- (iii) **Invalid:** Kaizen costing approach involves everyone from top management level to the shop floor employees. Every employee's active participation is a must requirement.
- (iv) **Invalid:** Though the aim of Kaizen Costing is to reduce the cost but at the same time it also aims to maintain the quality. Kaizen costing also aims to bring the clarity in roles and responsibilities for all employees.
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## Life Cycle Costing

### Problem-12

*Fiona is a news reporter and feature writer for an economic daily. Her assignment is to develop a feature article on 'Product Life-Cycle Costing', including interviews with the Chief Financial Officers (CFO) and Operating Managers. Fiona has been given a liberal budget for travel so as to research into company's history, operations, and market analysis for the firm she selects for the article.*

### **Required**

*Fiona has asked you to recommend industries and firms that would be good candidates for the article. What would you advise? Explain your recommendations.*



**Solution**

The product life cycle span the time from the initial R & D on a product to when customer service and support is no longer offered for that product.

Life Cycle Costing technique is particularly important when:

- (i) High percentage of total life-cycle costs are incurred before production begins and revenue are earned over several years and
- (ii) High fraction of the life cycle costs are locked in at the R & D and design stages.

Fiona should identify those industries and then companies belonging to those industries where above mentioned feature are prevalent. For example, Automobile and Pharmaceutical Industries companies like Tata Motors Ltd., Ranbaxy Laboratories Ltd., and Dabur India Ltd. will be good candidates for study on product life cycle costing.

**Problem-13**

Examine the **Validity** of following statements:

- (i) In the introduction stage, usual marketing strategy is to strengthen the supply chain relationships to make the product easily accessible by target customers.
- (ii) In the introduction stage, competitors will purchase the product to carry out reverse engineering and understand how the product works, so that they can develop their own similar, but different product.
- (iii) In the introduction phase, the firm will seek to avoid this competition by maintaining its selling price at the end of the introduction stage.
- (iv) In the growth stage, if the product cannot be differentiated in other ways, the firm may need further reductions in selling price to maintain growth.
- (v) In the maturity stage, firms are tempted to engage in costly promotional price wars to wean away market share from competitors.
- (vi) In the decline stage, failing sales may induce firms to slash marketing expenditure. Brand loyalty will be exploited to create profits.



**Solution**

**Valid or Invalid**

Sl. No.	Statements	Valid or Invalid
(i)	In the introduction stage, usual marketing strategy is to strengthen the supply chain relationships to make the product easily accessible by target customers.	Valid
(ii)	In the introduction stage, competitors will purchase the product to carry out reverse engineering and understand how the product works, so that they can develop their own similar, but different product.	Valid
(iii)	In the introduction phase, the firm will seek to avoid this competition by maintaining its selling price at the end of the introduction stage.	Invalid

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(iv)	In the growth stage, if the product cannot be differentiated in other ways, the firm may need further reductions in selling price to maintain growth.	Valid
(v)	In the maturity stage, firms are tempted to engage in costly promotional price wars to wean away market share from competitors.	Valid
(vi)	In the decline stage, failing sales may induce firms to slash marketing expenditure. Brand loyalty will be exploited to create profits.	Valid

## Cost Control Vs Cost Reduction

### Problem-14

Classify the following items under the more appropriate category:

Category (CC) – Cost Control Or Category (CR) – Cost Reduction:

- (i) Costs exceeding budgets or standards are investigated.
- (ii) Preventive function
- (iii) Corrective function
- (iv) Measures to standardize for increasing productivity
- (v) Provision of proper storage facilities for materials.
- (vi) Continuous comparison of actual with the standards set.
- (vii) Challenges the standards set
- (viii) Value analysis



### Solution

#### Classification of Items under Cost Reduction (CR)/ Cost Control (CC)

Sl. No.	Item	Category CC/ CR
(i)	Costs exceeding budgets or standards are investigated	CC
(ii)	Preventive function	CC
(iii)	Corrective function	CR
(iv)	Measures to standardize for increasing productivity	CR

(v)	Provision of proper storage facilities for materials	CC
(vi)	Continuous comparison of actual with the standards set	CC
(vii)	Challenges the standards set	CR
(viii)	Value analysis	CR

## Value Chain Analysis

### Problem-15

*ABC Ltd. is engaged in business of manufacturing branded readymade garments. It has a single manufacturing facility at Ludhiana. Raw material is supplied by various suppliers.*

*Majority of its revenue comes from export to Euro Zone and US. To strengthen its position further in the Global Market, it is planning to enhance quality and provide assurance through long term warranty.*

*For the coming years company has set objective to reduce the quality costs in each of the primary activities in its value chain.*

### **Required**

*State the primary activities as per Porter's Value Chain Analysis in the value chain of ABC Ltd with brief description.*



### **Solution**

Primary activities are the activities that are directly involved in transforming inputs into outputs and delivery and after-sales support to output. Following are the primary activities in the value chain of ABC Ltd.:-

- (i) **Inbound Logistics:** These activities are related to the material handling and warehousing. It also covers transporting raw material from the supplier to the place of processing inside the factory.
- (ii) **Operations:** These activities are directly responsible for the transformation of raw material into final product for the delivery to the consumers.
- (iii) **Outbound Logistics:** These activities are involved in movement of finished goods to the point of sales. Order processing and distribution are major part of these activities.
- (iv) **Marketing and Sales:** These activities are performed for demand creation and customer solicitation. Communication, pricing and channel management are major part of these activities.
- (v) **Service:** These activities are performed after selling the goods to the consumers. Installation, repair and parts replacement are some examples of these activities.

**Problem-16**

Examine the Validity of following statements along with the reasons:

- (i) *The concepts, tools and techniques of value chain analysis apply only to all those organizations which produce and sell a product.*
- (ii) *Procurement activities are included in the Primary activities as classified by Porter under value chain analysis concept.*
- (iii) *As per Porter's five forces model, bargaining power of buyers does influence the profitability of an industry or market.*
- (iv) *Value chain analysis in the strategic framework consists of single cost driver concept.*



**Solution**

- (i) **Invalid**  
The concepts, tools and techniques of value chain analysis apply to organizations which produce and sell a product and also to organizations which provide a service.
- (ii) **Invalid**  
Procurement activities are included in the support activities rather than primary activities.
- (iii) **Valid**  
Bargaining power of buyers is one of the factor or force that influences the profitability of a market or industry. More the bargaining power buyers have, more the pressure on the industry to not increase the price of product or service. They may even have to reduce the price sometimes.
- (iv) **Invalid**  
Value chain analysis in the strategic framework consists of multiple cost drivers concept. In value chain analysis, a set of unique cost drivers is identified for each value activity instead of single cost driver application at the overall firm level. Multiple cost drivers may be classified into Structural drivers and Executional drivers.

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## Just In Time

**Problem-17**

*Indian Petrons Ltd. (IPL) is a leading manufacturing company. Under increasing pressure to reduce costs, to contain inventory and to improve service, IPL's Costing Department has recently undertaken a decision to implement a JIT System.*

*The management of IPL is convinced of the benefits of their changes. But Supplies Manager Mr. Brian fears with the Costing Department's decision. He said:*

*"We've been driven by suppliers for years ... they would insist that we could only purchase in thousands, that we would have to wait weeks, or that they would only deliver on Mondays!"*

*Is Mr. Brian's view point correct and why?*



### Solution

#### JIT Inventory System

*"For successful operation of JIT inventory system, the suppliers chosen must be willing to make frequent deliveries in small lots. Rather than deliver a week's or a month's material at one time, suppliers must be willing to make deliveries several times a day and in the exact quantities specified by the buyer."*

It is described in the problem that suppliers are not willing to

- make frequent deliveries and
- make supplies in the exact quantities as required

Accordingly Mr. Brian's doubt is correct on successful implementation of JIT System.

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